Vol. 6 No. 1 March, 1947

ANNALS OF THE RHEUMATIC DISEASES

EDITORS
C. W. BUCKLEY
W. S. C. COPEMAN G. D. KERSLEY

EDITORIAL COMMITTEE

LORD BRABAZON
C. H. ANDREWES
S. C. BARR
NORMAN CARDER
L. S. P. DAVIDSON
S. G. DORDOY
A. G. TENDRILL FISHER
C. BRUCE FORTY
PERCY STOCKS
PHILIP S. HENCH (U.S.A.)
LORING T. SWAIM (U.S.A.)
PRESIDENT OF THE AMERICAN RHEUMATISM ASSOCIATION
PRESIDENT OF THE CANADIAN RHEUMATISM ASSOCIATION
EDITOR, [illegible]

APPOINTED BY THE
BRITISH MEDICAL ASSOCIATION AND THE EMPIRE RHEUMATISM COUNCIL

CONTENTS

	PAGE
X-ray Appearances in Chronic Rheumatism. GEORGE D. STEVEN	1
Intestinal Extract in Rheumatic Diseases. ARNOLD RENSHAW	15
Psychosomatic Non-Articular Rheumatism. E. P. EDMONDS	36
Hebridean Society	50
Royal Society of Medicine (Sections of Medicine and Physical Medicine)	54
Abstracts	55
Obituary	64

LONDON
BRITISH MEDICAL ASSOCIATION
TAVISTOCK SQUARE, W.C.1

YEARLY SUBSCRIPTION (4 NUMBERS) 25/- U.S.A. $6.00 SINGLE NUMBER 7/6

NOTICE TO SUBSCRIBERS

Subscriptions to the British Medical Association. Address: British Medical Association [illegible], London, W.C.1.

NOTICE TO CONTRIBUTORS

Papers [illegible] nal are accepted on the understanding that they have not been and will not be published in any other journal, and are subject to editorial revision. All papers and other [illegible] should be addressed to Dr. C. W. Buckley, Bentley Cottage, Ashbourne, [illegible].

The author of [illegible] cle should make adequate references to previous work on his chosen subject.

A full summary of [illegible] ations and conclusions must be given.

A paper describing [illegible] case will not be accepted unless the case is sufficiently rare, or shows important [illegible] ously described, or has been made a subject of special observation or experiment.

Articles and letters [illegible] possible and be typewritten on one side of the paper only, with double spacing [illegible] ot less than 1½ inches. Only recognized abbreviations should be used. Graphs [illegible] and legends for them should be presented on separate sheets and not included [illegible] en half-tone reproduction of x-ray illustrations is required, the author is advised [illegible] al film unless he wishes to bring out special points in a print of his own choice. [illegible] photomicrographs should be printed on glossy paper, should be larger than [illegible] reproduction, and, if transmitted through the post in a tube, should be rolled [illegible] outside. With the exception of letters and numbers, which should be [illegible], everything that is to appear in the reproduction of a graph or chart should be [illegible] black ink on tracing linen, or Bristol board, or stout, smooth, white paper.

References should be [illegible] according to the Harvard system. In the text, the year of publication [illegible] r's name, more than one paper in any one year being indicated by a small letter [illegible] date. No numbering of references is necessary. At the end of the contribution [illegible] anged in the alphabetical order of the author's names. The reference should [illegible] ws: Author's name and initials, year of publication (in parentheses), title of [illegible] abbreviated according to the *World List of Scientific Periodicals*), volume number [illegible] bic numerals), and first page number (ordinary type, Arabic numerals), thus:

[illegible] J. (1929). *Quart. J. Med.*, 22, 237.

When a book is [illegible] d, the full title, publisher, the place and year of publication, edition and page number should be given.

Contributors will be supplied with a proof in page, but it is assumed that all but verbal corrections have been made in the manuscript; an allowance at the rate of ten shillings per sheet of sixteen pages will be made for alterations in the proof (printer's errors excepted), and contributors will be responsible for the cost.

Fifty free reprints will, if desired, be given to contributors. A limited number of additional reprints can be supplied if application is made when returning proofs. An estimate of cost will be given on application to the Publishing Manager, British Medical Association.

Papers when published become the property of this Journal, and permission to republish must be obtained from the Editors.

Applications for [illegible] nt space should be addressed to the Advertisement Manager, British Medical [illegible] Tavistock Square, London, W.C.1.

X-RAY APPEARANCES IN CHRONIC RHEUMATISM

BY

GEORGE D. STEVEN

From the Royal National Hospital for Rheumatic Diseases, Bath

Radiography provides us with a means of studying the structure and architecture of bones and joints. The normal bone shadowing presents definite and recognizable features. The fundamental processes which maintain the normal bone appearance throughout life are few in number, and disturbance of any of these processes is a feature of more than one disease. It is fortunate, for the purpose of differential diagnosis, that the diseases have certain individual characteristics in the combination of changes they produce when disturbing these fundamental processes. One type of change may be specially pronounced, but in that case others must be looked for before the evidence can be considered of more than presumptive diagnostic value. As one might expect in diseases of chronic type, changes at various stages of activity or quiescence may be found in one and the same patient. It is the active processes which produce the characteristic features, whereas reconstructive and degenerative changes may obscure the nature of the quiescent lesions. Gross abnormality, therefore, is often a hindrance rather than a help even to the skilled observer. It may be just as necessary to search assiduously with a magnifying lens over bones which are grossly osteoporosed or honeycombed with punched-out areas as it is for minimal changes of early disease. The clinician and the pathologist are no doubt faced with somewhat similar difficulties in the complex phases of these diseases, and no one form of examination should be considered a short cut to the diagnosis of chronic rheumatism. The experienced radiologist usually correlates his findings with the clinical and pathological features, as these must have some bearing on the interpretation of changes which appear on a radiograph. By this means he may be able to give a presumptive report when certain signs are present, instead of an indeterminate one which would be of no informative value. To conform with this team work, the radiologist usually refers in his report to changes being of a certain disease type. This leaves the clinician to decide if further investigation is required before the diagnostic label is applied to the case.

In the following brief survey the principal diseases and disorders which will be considered are the familiar triad, rheumatoid arthritis, osteo-arthritis, and gout. Where terms such as "early", "established", "late", "active", or "quiescent", are used, they will refer to local lesions unless otherwise stated, since all forms may be found in one and the same patient, whether the disease is early or advanced.

Rheumatoid Arthritis

The early changes of active disease (presumptive) are : (1) osteoporosis of generalized type affecting all the bones of the skeleton : exaggeration of contrast in shadowing between shafts and ends of bones ; (2) spindle-shaped swelling of soft tissues around the affected finger joints, and possibly slight increase in the joint space from effusion.

The established changes of active disease (typical) are : (1) an increase in generalized osteoporosis : local patterns from predominance of osteoporosis in the more vascular areas ; (2) diminution of cartilage of uniform character ; (3) localized osteoporosis affecting the articular cortex of some joints ; (4) erosion of articular cortex and underlying spongiosa, especially at the articular margins, with a localized osteoporosis in the eroded trabeculae.

Late changes of very chronic or quiescent disease (obscured) are : (1) return to normal contrast between spongiosa and compact bone, but with recovery of the bone density rarely complete ; (2) the loss of cartilage maintained or increased, and remaining uniform in character ; (3) irregular new bone covering the eroded trabeculae, reconstructive changes with cystic enclosures, and greater density in the ends and shafts of bones where articular surfaces are eroded ; (4) subluxation, especially ulnar deviation of the fingers ; (5) ankylosis, especially across gliding joints destroyed by erosion ; (6) spiky lipping at the articular margins, and scanty sclerosis of secondary osteo-arthritic type.

Osteoporosis

Osteoporosis in rheumatoid arthritis is of a generalized type affecting all the bones of the skeleton. For technical reasons it is best demonstrated in the bones of the hands where its early detection is possible. The hands also serve to show a bilateral (general) involvement. Although the osteoporosis is general in character, it predominates in more vascular bone such as the spongiosa. The result of this is to exaggerate in a striking manner the normal contrast in structural shadowing between the shafts and ends of bone. The richer blood supply on either side of an epiphyseal line causes translucent zones to appear there, and a distinctive pattern is produced by this in large bones, especially in the lateral radiograph of the knee joint. This pattern is helpful in demonstrating osteoporosis if no special technique has been employed for the radiograph of the hands, and sometimes if the condition in the hands is relatively quiescent. Large bones may also show a mottled appearance when the process is very active. These patterns are only of value as manifestations of the abruptness of the process in rheumatoid arthritis. They may be seen in other diseases, but not, for example, in osteoporosis of senile type where the process is more gradual and orderly. The diminution of opacity in the spongiosa is due to the trabeculae becoming progressively thinner, but there is no actual destruction of trabeculae as in local infections. The translucent intertrabecular spacing is wider as a result of the thinning process, and not because of any change in the architectural structure such as one finds in hyperparathyroidism (osteitis fibrosa). Diminution in opacity of compact bone lags behind the spongiosa in active stages, but catches up when the disease is well established. In the quiescent stage there is a return to the normal contrast in structural shadowing, but recovery of bone density is seldom if ever complete.

The radiographic features observed in generalized osteoporosis of rheumatoid

arthritis are consistent with pathological findings, suggesting that the process is one of deossification by osteoclastic activity. There is a disturbance of the mechanism which controls the balance between osteoclastic erosion and osteoblastic replacement in the normal living bone with the former outstripping the latter. Action on the controlling mechanism accounts for the generalized nature of the osteoporosis. As the osteoclastic process is one of cellular activity requiring oxygen and nutritional fluids, one would expect more vigorous action where there is a rich blood supply and a large surface area such as is found in the spongiosa and other areas where patterns are produced.

Generalized osteoporosis may be the only obvious radiographic sign in rheumatoid arthritis. In such a case it is consistent with the disease and of presumptive value when correlated with a rapid sedimentation rate in an adolescent or adult with spindle-shaped swellings of the finger joints. A magnifying lens should be used in the study of affected joints, and especially over the heads of the metacarpals, for the possible presence of early but significant local joint changes.

Loss of Articular Cartilage

Articular cartilage is responsible for the uniform joint space with which we are familiar. In the early rheumatoid case the space in some of the smaller joints may be slightly widened by synovial effusion, and spindle-shaped swelling may be noted in the surrounding soft tissues. In established rheumatoid arthritis the local joint changes present a more characteristic feature in the form of diminution of joint space of a striking uniform character. The metacarpo-phalangeal, proximal interphalangeal, and carpal joints are chiefly affected, but corresponding joints of the feet and the large joints may also be involved. In late rheumatoid arthritis the loss of cartilage is maintained or increased. Cartilage is a tissue of low vascularity, and shows little evidence of recovery after gross destruction.

Special mention must be made of a group of cases which show loss of cartilage in one or two of the finger joints only, and no sign of any osteoporosis. These cases are usually of the secondary rheumatoid type, the probability being that local or focal infection has produced a transitory or minimal general disturbance which is no longer in evidence, whereas any local damage to cartilage remains.

The radiographic appearance associated with loss of cartilage is consistent with pathological findings of surface erosion of cartilage by a pannus of granulation tissue. Cartilage has a poor blood supply of its own, and receives nourishment from the surfaces which are better provided. As granulation tissue is highly vascular, it spreads more easily over the surfaces and attacks the cartilage uniformly from that direction.

Erosion of Articular Cortex

(*a*) A localized type of osteoporosis may be detected by the trained eye along the articular cortex of some joints, especially in the heads of the metacarpals close to the joint margins. It may be present with or without obvious loss of cartilage.

It is a local sign of great importance, as it is not found in diseases causing generalized osteoporosis only. Examination of films of the same patient as the disease advances will show that this is early evidence of erosion of the articular cortex of rheumatoid type. It is given prominence as a little-known sign of local joint change. It may be the only sign of local involvement, but it is equally important to find it when adjacent joints are at a late stage, and simulating gout. The radiographic appearance is consistent with the pathological finding that granulation tissue spreads under as well as over articular cartilage. Increased vascularity associated with granulation tissue produces increased osteoclastic activity in the affected cortical bone. The appearance should be confirmed with a magnifying lens.

(*b*) Frank erosions of rheumatoid type have a predilection for articular margins where they destroy the cortex and scoop out the underlying spongiosa. In early stages they may be small and overshadowed or concealed by other bone, unless they happen to lie at margins shown in the standard radiographs of the hands. Anterior erosions may be equally common, but they require a special oblique projection to show them up if they are not deep enough to appear as round, translucent faults in the structural shadowing. It is most important to study an erosion in profile, as it is a feature of rheumatoid arthritis that the uncovered trabeculae show a narrow zone of local osteoporosis immediately adjacent to the erosion, whereas this is not so in gout. In established rheumatoid arthritis the erosions are usually deep enough to involve margins visible in the standard radiograph, and they sometimes spread over the articular surface in some joints. In the late stage of rheumatoid arthritis a lining of new bone covers the eroded spongiosa, and the zone of trabecular osteoporosis is no longer present. The lining is at first thin and waxy, consisting of non-lamellar bone, like callus ; but later it becomes organized and lamellar. Buttressing of damaged articular surfaces may take place, with formation of enclosed cystic areas, the cysts being also lined with a thin layer of new bone. The ends and adjacent shafts of bones which have suffered destruction of their joint surfaces show a hazy uniform density which may be partly sclerosis and partly due to impaired vascularity. These bones are less affected by the generalized osteoporosis of recrudescent disease than others which suffered less in previous attacks.

The radiographic appearances are consistent with erosion by granulation tissue, this being most vigorous in its action at the vascular articular margin. The vascularity of granulation tissue also accounts for the localized zone of osteoporosis in the uncovered trabeculae immediately adjacent to the erosions, since normal osteoclastic activity would stop abruptly at the line of erosion and the adjacent trabeculae would appear normal in density. The latter type of erosion is found in gout, which is described below as chiselled out and not osteoporosed. This differential feature between rheumatoid arthritis and gout applies while the local process is in an active phase, but is obscured at a later stage of quiescence in the local condition, when new bone covers the eroded trabeculae. One is constantly

seeing cases with multiple lesions in this difficult stage, but the skilled observer will look for, and possibly find, one local lesion which adds to the diagnostic value of the radiograph. If no active local erosion is seen, the search may be rewarded by finding areas of osteoporosis in the articular cortex such as are described in section (*a*) above, and this is of particular value as a more common finding in rheumatoid arthritis. If no typical changes are discovered in the local lesions, the presence of generalized osteoporosis still remains as the chief differential feature of rheumatoid arthritis.

Subluxation

Ulnar deviation of the fingers at the metacarpo-phalangeal joints is a familiar deformity of rheumatoid arthritis. It is usually a feature of late stages of the disease, but occasionally marked subluxation without evidence of erosion of joint surfaces is found. In these cases abnormal laxity or marked involvement of the capsule and capsular ligaments must be presumed. The reason for deviation in the ulnar direction is not apparent. Erosions are usually more marked on the radial side of the heads of metacarpals, but it is doubtful if local joint changes could account for such frequent displacement to the ulnar side, and a neuro-muscular explanation may be forthcoming. In late stages subluxation can be still more varied, and deformity may be pronounced.

Ankylosis

Bony ankylosis is seen radiographically to be a frequent end-result in rheumatoid arthritis when there is complete loss of articular cartilage and erosion of opposing articular surfaces by granulation tissue. Gliding joints, such as the carpals and tarsals, are chiefly involved, but the condition may be found in other small and large joints. It is a true bony ankylosis crossing the whole joint surface, and linear trabeculae are eventually seen running in orderly fashion along the lines of force. Dense sclerosis of articular surfaces may result instead, with clinical signs of fibrous ankylosis.

Secondary Osteo-arthritic Changes

Degenerative changes of osteo-arthritic type are a natural sequence to rheumatoid arthritis in late quiescent stages, because of abnormal stresses and strains in the disorganized joints. Osteophytic formation is at first of spiky type, and osteosclerosis scanty ; but later the changes may become more marked and may obscure the primary condition. The appearance of uniform loss of cartilage in an apparently osteo-arthritic hip joint may be a distinguishing feature which further investigation may confirm.

Osteo-arthritis

The earliest change (presumptive) is osteophytic formation of beak-shaped type at the place of insertion of capsular ligaments to joint margins.

Established changes (typical) are : (1) loss of cartilage of a one-sided character, resulting in faults in bone position or alignment and corresponding shift in lines of stress ; (2) osteophytic formation at margins where stress is increased, with either imperfect attempts at bone bridging or outgrowths in the direction of the plane of the joints ; (3) separate ossicles in the middle of capsular ligaments in some interphalangeal joints ; (4) hypertrophic bone outgrowths of terminal phalanges (Heberden's nodes) ; (5) osteosclerosis in subarticular bone, and coarsening of trabeculae along lines of stress.

Late changes (obscured) are : (1) gross loss of cartilage ; (2) eburnation, with pitting of articular surfaces ; (3) subarticular cystic degeneration ; (4) subluxation.

Osteophytic Formation

Lipping seen at the attachments of capsular ligaments is only presumptive evidence of osteo-arthritic disease, as this is the normal reaction to excessive local stress and strain and is common in athletic subjects after middle age. It may be an incidental finding in clinical fibrositis, or evidence of old trauma. Early lipping consists of small pointed spurs or rounded knobs of uniform density which project from bone immediately adjacent to an articular margin in the region of the attachment of capsular ligaments. Because of their uniform density they do not obscure the old outline of the bone to which they are attached. As the osteophytes grow in size they become more organized in character and present at least an outer layer of compact bone. The direction in which they grow appears to vary according to the nature of the strain which stimulates their formation. When the joint surfaces are tilted from loss of cartilage on one side, the osteophytes grow out on the side of angulation or concavity and are directed in the plane of the joint surfaces, as if to compensate for the extra strain which now falls on that side. These osteophytes usually remain pointed and may be large and very dense. When there is no gross loss of cartilage and the strain is mainly in the capsular ligaments, the osteophytes usually run in the direction of the ligaments and become beak- or hook-shaped. They are usually rounded at their ends, and may grow to large size, but they do not as a rule fuse with osteophytes which grow towards them from the opposing articular surfaces. They are not usually as dense as the pointed type, and often form part of a fringe of new bone which is more extensive than the radiographic appearance might suggest. Both types are well demonstrated in the lumbar spine, the one with wedge-shaped intervertebral disc, and the other with scoliosis from rotation of vertebral bodies. In both cases they predominate on the side of concavity. In late stages, when osteophytes are large and organized, they may show profuse outgrowths of organized bone close to the joint margin; and fragmented osteophytes or a moderate number of loose bodies may be present.

Separate ossicles of a different type are seen in the middle of the capsular ligaments of interphalangeal joints, lying opposite the joint, and sometimes in the anterior common ligament of the cervical or dorsal spine. They may be small and compact, or larger and cancellous in structure. They are characteristic of osteo-arthritic disease. Another change characteristic of osteo-arthritis is occasionally seen in the form of hypertrophic outgrowths of normal structural appearance at articular margins of terminal phalanges. They are quite different in

appearance from spurs of compact bone, and are a distinctive feature of Heberden's nodes. The other main features of Heberden's nodes are : gross loss of cartilage ; eburnation, with pitting of articular surfaces ; subluxation, with tilt of the phalanx ; and, of course, nodules or soft-tissue swellings over the hypertrophied bone. In late quiescent stages of any disease which disorganizes and deforms a joint, the occurrence of secondary osteo-arthritis is a natural sequel to the abnormal stresses and strains across the faulty joint, and may eventually obscure the primary disease. The radiographic appearances in osteo-arthritis are consistent with pathological findings that osteoblastic activity is stimulated by stresses, strains, and pressure. Early lipping consists of bone of uniform density, like callus, and this gradually becomes larger and more organized in character. If subject to pressure, it is likely to become very dense in structure ; if to torsional strains, it may form a fringe-like outgrowth of moderately dense new bone. Osteophytes predominate on the side to which there is any abnormal shift of stress and strain, and tend to compensate for deformity in position and alignment, or to limit the movements of the joints concerned. Hypertrophic outgrowths, described as typical of Heberden's nodes, are sometimes simulated by subperiosteal outgrowths in articular tophi of gouty arthritis.

Loss of Cartilage

Loss of cartilage is of a one-sided character, very different from rheumatoid arthritis. It occurs at the site of maximum stress and strain, and is usually more pronounced in large weight-bearing joints. The adjacent articular surfaces approximate to each other, so that joint surfaces are angled and the position or alignment of bones is altered. In late stages destruction may be almost complete, but seldom uniform. The appearance is consistent with a degenerative process in cartilage, which is a tissue of poor vascularity and low recuperative power. In osteo-arthritic disease the degenerative changes are multiarticular. Severe trauma followed by ordinary stress and strains may result in a more localized post-traumatic osteo-arthritis.

Osteosclerosis and Eburnation

Osteosclerosis is seen in established disease. There is an increase in thickness of the articular cortex where loss of cartilage is present, and a process of coarsening is seen in the adjacent trabecular shadowing. Coarsening of trabeculae is prominent along new lines of force which result from faulty position or alignment, the shift being to the side of approximated articular surfaces. Contact of bone surfaces in late stages results in dense bone formation or eburnation, and pitting of the eburnated surface is not uncommon. These appearances are consistent with stimulation of osteoblastic activity by stresses and strains or pressure. The coarse trabeculae along new lines of force are more orderly and purposeful than the more imperfect attempts seen in other diseases, such as Paget's disease.

Cystic Degeneration

Subarticular translucent areas are occasionally seen in early stages of osteo-arthritis before there is any obvious loss of cartilage or osteophytic formation. These cases are probably of traumatic type. Cystic degeneration is more often a feature of late stages, particularly in large weight-bearing joints, such as the hips. The translucent areas are subarticular and may involve a portion of the articular surface. They show a wall of compact bone, varying in thickness according to the size of the joint concerned. They lie in the position of greatest stress, such as under the highest point of the acetabulum in the hip joint (rheumatoid erosions predominate in vascular areas at articular margins). In late stages they may be more numerous and endosteal. Cystic degeneration, and the formation of pseudo-cysts, may be the result of a localized inflammatory reaction due to trauma, with resulting localized osteoclastic activity. They may, on the other hand, result from small areas of aseptic necrosis.

Chronic Gout

Early changes (presumptive) are : (1) hazy soft-tissue shadowing affecting bone detail and contrast (out-of-focus appearance) ; (2) local soft-tissue swellings at joints (not fusiform).

Established changes (typical) are : (1) osseous tophi—subchondral, endosteal, and medullary —and predilection for the articular margin, with erosion of the articular cortex ; (2) loss of cartilage, formation of articular tophi, and subperiosteal outgrowths at margins of tophi ; (3) osteosclerosis, usually wavy and irregular, and irregular calcium deposits in bone.

Late changes (obscured) are : (1) osseous tophi walled in by compact bone. Coarse wavy buttressing with pinhead and honeycombed translucencies ; (2) secondary osteo-arthritic changes ; (3) ankylosis in some joints.

Soft-tissue Changes

Soft-tissue changes in chronic gout consist of local periarticular swellings which are not fusiform as seen in rheumatoid arthritis. The swellings and tissue changes produce a hazy shadowing which makes the structural bone detail look " out-of-focus ". There is also a false impression of exaggerated contrast in the ends and shafts of the bones of the hands, almost simulating rheumatoid arthritis; but closer examination shows that there is no generalized osteoporosis in gout. Calcification of tophaceous swellings in soft tissues is seen in late stages of the local condition.

Osseous Tophi

Osseous tophi have a predilection for subchondral articular margins, and they commonly erode the adjacent articular cortex. These erosions present a typical appearance during the active process of deposition of sodium biurate crystals, provided the erosions are seen in profile. The appearance is that of complete loss of a small portion of cortex and underlying spongiosa, and two features are noted : (*a*) the cortex immediately adjacent is quite unaffected in its structure and density and ends abruptly at the erosion, or may even over-ride the

translucent area ; (*b*) the uncovered trabeculae are also of normal structure and density and not osteoporosed as in an active rheumatoid erosion. This abrupt transition from translucency to normal structural shadowing may also be detected during active deposition in endosteal tophi in the spongiosa. When small, the tophi are usually circular or oval, and are commonly seen in this form in the heads of the metatarsals. With increased deposit of sodium biurate a group of small translucencies may appear close to the periphery of the larger tophus, and if these merge together the larger tophus will show a crenated or honeycombed outline. Multiple small deposits are sometimes seen under the articular cortex, giving an appearance of spotted or zonal translucency under a cortex of normal density. In the base of a phalanx the tophi are often wedge- or lozenge-shaped with a point directed up the shaft between eroded main trabeculae. Endosteal tophi close to the medulla are obscured by overlying bone, and in the earlier stages give an impression of local osteoporosis only. During quiescence in the local process, the translucent areas become lined with new bone, which may be thin or thick according to the size of the tophus. If only a few small tophi are seen and they are lined in this way, there is difficulty in differentiating them from traumatic and other lined cysts, and more active lesions have to be looked for.

The radiographic appearances are consistent with the normal chiselling-out effect produced by osteoclasts. The process is seen to end abruptly at the margin of the eroding cells. In gout there appears to be no overactivity of the osteoclasts, but the presence of sodium biurate deposits inhibits the action of osteoblasts which would normally replace the eroded bone. In rheumatoid arthritis the erosion by osteoclasts is stimulated by granulation tissue, and the process outpaces the osteoblasts with the result that a zone of osteoporosis is seen.

The process of lining erosions of the cortex and spongiosa with new bone must be preceded by the formation of osteoid tissue which is translucent to *x* rays. Non-lamellar bone of callus-like appearance then forms, and this is finally replaced by lamellar bone. The biurate deposits in the tophus are probably superseded by inactive material before these changes take place, and to all intents and purposes the primary condition in the local lesion becomes masked by a process common to other forms of erosion. Difficulties such as this emphasize the need for careful scrutinizing of local lesions and for correlation of the appearances with other changes or combination of changes. Mistakes will be avoided if this routine is followed.

Loss of Cartilage and Formation of Articular Tophi

Diminution of cartilage of somewhat uniform character is seen in chronic gouty arthritis. The process is not as a rule early, and is usually preceded by tophaceous deposits in the bones. In late stages the loss of cartilage may be complete, and associated with gross erosion of articular surfaces. The articular surfaces may come in contact, and the local condition may end in ankylosis.

The radiographic appearance is consistent with the finding of spiky sodium

biurate crystals in the surface layers of articular cartilage where they have been deposited from overloaded synovial fluid. Ankylosis would be explained by a final invasion of granulation tissue.

The formation of articular tophi presents a still more typical appearance of gouty arthritis. In this case the deposit of crystals accumulates, and the eroded articular surfaces are seen to be widely separated by a translucent space, with one bone apparently floating above the other. In some of these cases another characteristic feature is seen in the form of outgrowths of subperiosteal bone from the articular margins, which go partly round the tophi, but usually end in a point as if failing in the attempt.

Osteosclerosis and Buttressing

Coarse, irregular trabecular shadowing is seen in late stages of local gouty changes in bone. The sclerosis is wavy, and not orderly as in osteo-arthritis. Denser shadowing from calcium deposits in bone may also be seen. When tophi are surrounded by sclerosis and a wall of new bone, they are quiescent, and the biurate crystals have probably been replaced by inactive material. A honeycombed appearance is frequently seen, with intercommunication between the various sized translucencies—some of them appearing like pinholes in the new bone. Buttressing of damaged joints is also seen, the structural appearance again tending to be wavy.

Secondary Osteo-arthritis

Changes of secondary osteo-arthritic type appear in late stages of gouty arthritis, as may be expected in any disorganized joint which becomes liable to abnormal stresses and strains. Cancellous outgrowths are often seen at articular margins in gout, in addition to the more common spurs of compact bone. Secondary osteo-arthritis may be pronounced in large weight-bearing joints. In these joints gouty deposits are uncommon, and the primary condition may be obscured.

Summary of Differential Features

The differential features are summarized in the Table on page 11.

Differential Features in Other Diseases

Ankylosing Spondylitis.—In ankylosing spondylitis the predominant process is bony ankylosis spreading across the joint margins along the outer edge of the articular cartilage. It is usually seen first in the sacro-iliac joints as a bilateral process somewhat similar to the normal fusion which takes place between segments of the sacrum. The normal sharp outline of the articular margins disappears, the bone immediately adjacent to the articular surfaces becomes hazy and sclerosed, and the abnormal sclerosed bone forms a new outline which is extremely ragged—so much so that one gets the impression of lacunar areas of absorption in the articular cortex which add to the irregular shadowing produced by the new articular margins. In time the space between the articular edges appears to be crossed by interlacing shadows of new bone, and at a still later stage by definite trabeculation which is arranged in orderly manner along lines of force. The extent of osteosclerosis and osteoporosis in the affected bones varies in their relative

	Rheumatoid	*Osteo-arthritis*	*Gout*
Soft-tissue swelling	fusiform	nodular	lumpy
Osteoporosis	generalized	nil	local
Structural contrast	exaggerated	normal	hazy normal
Loss of cartilage	uniform	one-sided	varied
Marginal erosions	osteoporosed	nil	chiselled out
Articular erosions	preceded by osteo-porosis	pitted or pseudo-cystic	chiselled out
Translucent areas	trabeculae osteoporosed	compact wall	trabeculae chiselled out
,, (quiescent)	compact wall	compact wall	compact wall
Osteosclerosis	scanty secondary	orderly	wavy
Osteophytes	small spiky secondary	spur or fringe	hypertrophic and secondary
Intra-capsular ossicles	nil	interphalangeal	nil
Subluxation	ulnar deviation	tilt or slip	varied
Ankylosis	bony	incomplete bridging	bony
Subperiosteal outgrowths ..	nil	at Heberden's nodes	at articular tophi
Buttressing	orderly	rare	wavy honeycombed

amounts according to the acuteness of the disease. In acute cases the osteoporosis becomes very prominent and widespread, whereas in chronic cases the osteosclerosis is the more marked feature. The disease spreads centrifugally up the spine and sometimes to the symphysis pubis, and down to the joints of the lower limbs. A shaggy appearance is occasionally seen along the lower ramus of the pubic bones and ischium as a result of spiky periosteal outgrowths at tendon or ligamentous attachments. In the spine the disease involves the joints between the vertebral bodies and the articular processes, together with extension of the process of ossification to the interosseous ligaments. The ankylosing process is well shown in the lumbar and cervical spine, the lumbar spine being the most common site after the sacro-iliac joints. A uniform linear opacity is seen crossing from edge to edge of the joint between vertebral bodies along the outer aspect of the intervertebral discs (i.e. well inside the line followed by osseous bridging in spondylitis osteo-arthritica). As new bone is laid down the linear shadow broadens and may bulge out between the vertebrae so that the spine becomes bamboo-shaped. The new bone is quite dense compared with the vertebral bodies, which are usually osteoporosed. The involvement on one or other side and at different levels is usually more varied than the old text-book illustration of bamboo-spine would suggest. Involvement of interosseous and interspinous ligaments results in the so-called " tram-line " appearance, with three lines of relatively dense new bone running up the spine. Eventually these may show very strong linear trabeculation of orderly type, whereas the vertebral bodies remain osteoporosed. As regards the articular cartilage, this is enclosed and not invaded by the process, but it may eventually deteriorate. Changes in the articular processes of the spine are best seen in oblique views. A shaggy articular outline with an underlying narrow zone of dense bone may be seen in this projection. If such a combination of changes is found, the diagnosis is almost a certainty. The dorsal spine is usually less involved than the lumbar region. In some cases there is a general dorsal kyphosis with approximation of the anterior margins of the vertebral bodies, which may ankylose. The cervical spine shows ankylosis between vertebral bodies or articular processes, and not infrequently in both places. The extent to which the disease spreads varies considerably, and some cases show evidence of quiescent periods with mixed osteo-arthritic changes. The standard radiograph of the hands presents a normal appearance in all but very advanced cases, and this helps to differentiate ankylosing spondylitis from a rheumatoid arthritis which involves the spine.

STILL'S DISEASE.—Still's disease shows the *x*-ray features of rheumatoid arthritis in children, with predominance of generalized osteoporosis. Local joint changes may supervene.

SENILE ATROPHY AND DISUSE ATROPHY.—In senile atrophy, osteoporosis is of generalized type, but the process is extremely slow and does not produce exaggerated contrast in shadowing between shafts and ends of bone. The general architecture is little disturbed. Trabeculae become thinner, and some may gradually disappear. The compact bone forms a thin, shell-like outer covering, which is present also in the articular outline (distinct from rheumatoid arthritis). The appearance of osteoporosis of disuse is somewhat similar if no infective process is involved, but the condition is confined to the affected limb.

HYPERTHYROIDISM AND HYPERVITAMINOSIS D.—These cause a more abrupt type of generalized osteoporosis, but without the local joint changes of rheumatoid arthritis.

RICKETS AND OSTEOMALACIA.—These conditions produce a generalized osteoporosis and bone softening, not from overactivity of osteoclasts but from failure of osteoid tissue to calcify. In the growing bones of children the result of this is most marked at growing ends. Deformities from bone softening are likely to occur (bowing). Expansion of intervertebral discs at the expense of softened vertebral bodies in the adult spine produces a fish-spine appearance.

HYPERPARATHYROIDISM (OSTEITIS FIBROSA).—Generalized osteoporosis may occur, but the trabecular thinning is associated with a hyperplasia of intertrabecular tissue, with the result that there is a true widening of the intertrabecular spaces which may become cystic in places. Further architectural disturbance is seen by similar spaces occurring in layers of compact bone of the shaft which appears broken up by lines of translucency.

PAGET'S DISEASE.—Widening of intertrabecular spacing is seen which is somewhat similar to osteitis fibrosa but is accompanied by marked coarsening of trabecular shadowing. The architecture is more irregular and less purposeful than normal bone, and, although strong trabeculae appear along lines of force, they are imperfectly laid down. While dense in appearance, the affected bone is diminished in strength, and bowing deformity is seen with buttressing on the concave side from subperiosteal new bone. Osteo-arthritic changes are common in affected joints. Changes of Paget type may affect only part of one or more bones.

CHARCOT'S DISEASE.—Charcot's disease shows gross changes with loss of cartilage, eburnation, sclerosis, and multiple bone fragmentation.

SPECIFIC DISEASE.—There is irregular flaky coarse sclerosis which is not predominantly subarticular. There is also evidence of chronic periostitis, bowing, with new bone on the convex side, and local mottled shadowing or local osteoporosis.

TUBERCLE.—There is local bone or joint invasion, and local osteoporosis with ground-glass appearance in affected area (probably from the occluding effect of the tubercle on neighbouring blood vessels diminishing the osteoclastic activity compared with the surrounding vascular bone). Local trabecular destruction supervenes. In caries sicca of the shoulder joint, there is osteoporosis with articular erosions and subarticular sclerosis. The condition is usually monarticular.

OSTEITIS TUBERCULOSA MULTIPLEX CYSTICA (BOECK'S SARCOID).—Multiple translucent areas appear indistinguishable from quiescent gouty tophi in bones of the hands, but there is not the same predilection for marginal subchondral areas.

CARCINOMATOSIS.—In carcinomatosis from primary carcinoma of the prostate, osteoblastic changes may obscure the destructive process. The sclerosis is flaky, but in some cases a uniform density is produced in some of the bones. Some areas of bone destruction are likely to be seen.

MYELOMATOSIS.—Irregular osteoporosis results from widespread invasion of bone structure by small cell masses. In some places round or oval areas of bone destruction are likely to be seen.

MULTIPLE CHONDROMATA AND ENCHONDROMATA.—There are multiple translucent areas with a thin covering of compact bone. These may project or expand beyond the bone surface while still retaining their compact bone covering.

TRAUMATIC CYSTS.—These are small endosteal cysts with compact walls ; they are similar to the quiescent cysts of other conditions described.

OSTEOCHONDRITIS.—Osteochondritis may be primary to more obvious secondary osteo-arthritis. Expansion of the head of the femur, expansion and deformity of the head of the second metatarsal, and compression with sclerosis of the navicular or semilunar bones are examples.

SLIPPED EPIPHYSIS : SHALLOW ACETABULUM.—These are examples of other defects in joints which may be obscured by secondary osteo-arthritic changes.

UNUNITED OS ACETABULI.—This may be mistaken for a fragmented osteophyte.

PROTRUSIO ACETABULI.—This may be overlooked, owing to the dense osteosclerosis and secondary osteo-arthritis which obscures the fact that there has been a primary condition of bone softening.

Technique

Radiographic interpretation and differential diagnosis in chronic rheumatic diseases may be materially affected by a decision that osteoporosis is present or absent. There are certain fundamental principles in radiography which must be appreciated and applied before one can attempt to diagnose the presence of early osteoporosis. Radiographs taken of one and the same bone with different techniques will vary considerably in appearance, both as regards the detail and density of the shadows and the contrast between different parts of the bone. *X* rays of high penetrating value give a more uniform density to bone shadows than " soft " rays which produce greater contrast between the structural components. Under-exposure and under-development give less detail and an impression of greater bone density than over-exposure or over-development, which produce the opposite effect. Different distances of the *x*-ray tube from the film have not only a pronounced effect on exposure factors, but may alter the size of the bone shadow and its structure. It is desirable that all such factors should remain constant in any standardized technique if one is to become familiar with the normal and detect the early abnormal signs. The use of constant factors is possible only if the part to be radiographed is always of the same thickness, and the only bones and joints which conform to a reasonable extent with this requirement are those of the hands. The standard radiograph of the hands has been employed for this reason by hospitals which specialize in chronic rheumatic diseases, and this radiograph is usually taken for diagnostic purposes, whether the hand is requested or not. A normal hand would be helpful as a control, but this is impracticable. A useful substitute may be employed in the form of a small wax block in which is embedded the head with part of the shaft of a metacarpal bone (preferably the second metacarpal bone set in the anterior position). The block is 2 cm. thick, to correspond with the thickness of the hand. Wax has the same absorptive effect on *x* rays as the soft tissues of the body. General hospitals with clinics for chronic rheumatic diseases would be well advised to employ a standard technique for radiographing hands. There are difficulties in establishing any universal standard which would permit true comparison of films from different hospitals, but these difficulties are by no means insurmountable.

In cases of ankylosing spondylitis, where the hands as a rule are normal in appearance, it is desirable that a modified standard technique be employed—at least for the pelvis and lumbar spine. This can be achieved by measuring the actual thickness of the part under examination with calipers, and employing a specially prepared graph on which thickness appears on the abscissa, and one variable exposure factor (e.g. Kv or MaS on the ordinate).

Summary

The radiographic appearances of rheumatoid arthritis, osteo-arthritis, and gout are described. Differential features of some other diseases are given briefly.

A standard radiograph of the hands is recommended as a general routine for diagnostic purposes.

Attention is drawn to differential features of the local bone and joint changes in the hands during active phases of the three diseases mentioned, and similarity

in appearances during quiescence of the local bone condition is illustrated and explained.

Special attention is drawn to a local osteoporosis of the articular cortex which precedes and accompanies erosions of rheumatoid arthritis. It is not found in erosions from sodium biurate deposits of gouty arthritis, and a group of diseases which might simulate the generalized osteoporosis of rheumatoid arthritis do not show this local change.

It is stressed that changes in the active stages are of diagnostic value. Changes in the later stages may be predominant and misleading.

Team work with the clinician and pathologist is strongly recommended, and correlation of the radiographic interpretation with the clinical and pathological findings is advised as a routine procedure.

(*For Illustrations to this Article see page 27*)

INTESTINAL EXTRACT IN RHEUMATIC DISEASES

BY

ARNOLD RENSHAW

Manchester

Many theories, ranging from familial and climatic factors to specific focal infection, have been advanced from time to time to explain the aetiology of rheumatic diseases. None of these theories are, however, supported by incontestable data. Much attention has been given to defects and disease in the stomach, the gall-bladder, and the colon; but the functions of the small intestine have received little notice and less research.

As a result of numerous post-mortem examinations, sometimes as many as four or six a day for many years, the frequency with which atrophy of the small intestine occurred and the variations in the appearance of this organ when it was systematically opened and examined throughout its entire length impressed itself upon the writer. The conclusion was reached that rheumatoid arthritis might be a deficiency disease, with perhaps some associated allergic basis, and that the deficiency might arise from an inability to deal adequately with protein digestion and metabolism. It is to be noted that the area of the small intestine, excluding folds and villi, is at least nine or ten times that of the stomach, and Martin and Banks of McGill University (1940) showed that the weight of the dried intestinal mucosa is from three to five times that of the dried pancreas.

A special research was, therefore, instituted into the condition of the small intestine in rheumatic patients. It was difficult, especially during the war, to obtain post-mortem material from suitable cases, but a few typical cases were met with and histological material was also obtained from time to time by the kind help of Dr. R. Y. Dawbarn of Liverpool. Some of the material was the outcome of sudden death (cerebral haemorrhage, etc.) and was obtained within twenty-four hours of death—the external temperature being low or the bodies stored in ice chambers; but some specimens were only available two, three, or even in one case four days after death. Comparison has, however, been made histologically between these cases and that of animal intestines kept for a week after death which presented less severe changes. There is no doubt at all in the mind of the writer that the changes found represent a true disease process and are not autolytic. Some autolysis is, of course, possible; but changes such as fibrosis and endarteritis can by no means be regarded as such, nor can the denudation of the mucosa in large areas when the

nature of the underlying stroma is considered; in cases of Paget's disease the intestine shows a hypoplasia almost incredible in degree.

Sections of the small intestine were made at three levels: (a) 6 in. below the pylorus; (b) half way along the small intestine; (c) 6 in. above the ileo-caecal valve. Essentially the changes met with vary in degree according to the severity of the disease. Thus, patients showing moderate bone changes of rheumatic type may show less severe damage to the intestinal mucosa than is present in advanced cases. In the former the chief changes appear to occur in the lower part of the intestine (b, or c) whereas in the advanced cases all areas (a, b, and c) are affected. The amount of mucosal damage is also greater in the advanced and wasted rheumatoid cases. Thus Fig. 7, from a case of this type, shows complete denudation of the mucosa in places, with considerable disorganization of the glandular acini and an increase of interglandular material which is shown by van Gieson's stain to be due to a fine inter-acinar fibrosis, the acini presenting the appearance of being further separated from each other than is normally the case, and many acini (Figs. 8 and 9, p. 26) are completely disorganized, with an appearance of hyaline degeneration.

The blood supply in the normal intestine in both children and adults appears to be far richer than in the intestine of rheumatic patients. The latter frequently shows an advanced degree of endarteritis, which, by limiting the blood supply, must inevitably reduce the amount which that tissue receives and can convert into secretion. (For various changes see Figs. 1–11, pp. 22–26.)

Causes of Diminished Secretion

Mucosal degeneration and deficiency of secretion may be due to a variety of causes, chief of which are: improper or inadequate diet, including absence of certain vitamins; chemical poisons or intoxications, including lead and alcohol (Bray, 1937; quoted in *Brit. med. J.*, 1946); bacterial infections and toxins, including old tuberculous enteritis; and congenital tendencies leading to hypoplasia. Deficiency of secretion may be induced by mental or nervous disorders, shock, anxiety, etc.

It is known that food in the intestine stimulates the production of the succus entericus, and it is, therefore, probable that deprivation of the type of food which requires this secretion for its digestion would tend to produce disuse atrophy of the intestinal mucosa, and this has recently been confirmed by Magee (1945). He states that Sun, whilst working in his laboratory, drew attention to work which he had previously done (1927) on the effect of fasting on the epithelium of the gastro-intestinal tract. Sun showed that fasts of twenty-four hours or more caused progressive degeneration of the columnar cells of the intestine of white mice. After relatively long periods of fasting, all except the basal portion of the villi became disorganized and degenerated, and in extreme cases practically no trace of columnar epithelium or villi remained. Provided degeneration had not gone too far careful refeeding caused rapid regeneration. Magee also states that changes of the same type are referred to by Jackson (1925) and states that these findings

indicate that deprivation of food progressively destroys the digestive, absorptive, and protective functions of the alimentary canal, and also it would seem to impair the metabolic functions.

Experimental Method

In view of these observations it was decided to test the effect of extract of intestinal mucosa in the treatment of patients suffering from rheumatism of various types, and for this purpose a firm of enzyme specialists agreed to prepare an extract of intestinal mucosa rich in erepsin and to use the resources of their laboratories for the necessary tests. The resulting product was presented in enteric-coated capsules for oral administration; these were designed to release their contents one hour after being swallowed. Since the hydrochloric acid of the gastric juice would inactivate the enzymes, an interval of two and a half hours after food seemed to be the optimum time for administration; this would allow the intact capsule to pass into the duodenum, there to dissolve and liberate its contents for subsequent action in an alkaline medium. Before the extract was administered to human beings, preliminary animal feeding experiments failed to show any evidence of toxicity. Later, inoculation experiments with a sterile extract were performed on animals before a parenteral method of administration was tested.

Treatment of patients with this extract have now been proceeding for seven years. Most types of rheumatic disease have been treated—rheumatoid arthritis, osteo-arthritis, fibrositis, synovitis, intermittent hydrarthrosis, acute and subacute rheumatism, and spondylitis. Patients under ten years of age and over eighty have received treatment. In some the illness was of recent duration; in others there was a history of twenty-five years or more. Among over 700 cases treated by the writer personally, good results have been obtained in rheumatoid arthritis, osteo-arthritis, and fibrositis. Some intractable cases of ankylosing spondylitis and Still's disease have also responded to this therapy. The treatment has been carried out at a clinic at Ancoats Hospital, Manchester, and in private practice, and the results have been observed by many physicians and general practitioners. Criteria for diagnosis and classification of results were drawn up with the assistance of physicians specializing in rheumatic diseases.

Results

In a series of 556 cases of various types, 283 were found to be much improved, and a further 219 were improved to a less marked extent. Of 292 cases of rheumatoid arthritis, 264 showed improvement of various degrees. Improvement was also noted in other forms of rheumatism. Children with Still's disease responded very well in the few cases treated, and relief of pain was frequently reported by patients with osteo-arthritis.

Controls

Some patients after treatment with an active extract have been given inactivated capsules without their knowledge. After three or four months of this the condition was noticed to deteriorate, to improve again when the genuine capsules were resumed—again without the patients being informed that a change of capsule had occurred. Other cases have relapsed on discontinuance of treatment after initial improvement, to improve again when intestinal extract treatment was resumed. Further controls have been afforded by the adoption of this treatment by patients

who had relapsed after other methods but who improved with this method. Many cases had previously been treated with vaccines, gold, and other measures.

The technique which has been found to be the most effective, case reports, and statistics cannot be included in this paper for want of space, but will be the subject of a later report. Ancillary treatment has been avoided as far as possible as being likely to vitiate the conclusions to be drawn as to the effect of the method under consideration. A maintenance dose appears to be necessary for long after the disease has appeared to show any sign of activity. This compares with pernicious anaemia, diabetes, hypothyroidism, etc., and supports the theory that many forms of rheumatism are due to some systemic deficiency.

Case Report

One case may be described, as it illustrates many points in the treatment, and was examined both before and after a long course of treatment, by independent observers.

A male, aged 36, occupation compositor, showed the first signs of rheumatoid arthritis in 1939 but was accepted for the R.A.F. in 1941; the disease became more active and he was in hospital for six weeks and was subsequently discharged. The joints affected were the hands, wrists, elbows, knees, and feet. When he came to the clinic he had to be brought by ambulance and carried in; he could dress himself, but could walk only very little and on some days was much worse than others. Treatment by the intestinal extract was begun on Feb. 10, 1943, and for the first two or three months there was little change; in fact he was if anything slightly worse in regard to generalized pain but the swelling of the joints was lessening and the range of movement was increasing. By the beginning of June he was able to walk with assistance, he was more cheerful, looked better, and his colour was improving. A few weeks later he was able to walk a mile and a half, but swelling of the ankles, and occasionally of the knees also, still occurred from time to time, up to November, when the dose of the extract was increased to 42 units (seven capsules) daily. By March, 1944, he could ride his bicycle, and soon was doing so on most days. In May his condition was reviewed by a Medical Board, as he had been in receipt of a pension from the Ministry, part of which was to defray the cost of his treatment. He continued to improve; the pain in the feet was relieved to some extent by metatarsal bars, and in November, 1944, he resumed his work as a compositor. In March, 1945, a Medical Board found him so much better that his pension was withdrawn. His weight improved from 6 st. 5 lb. at the beginning of treatment to 7 st. 12 lb. in January, 1944. When last examined, in October, 1945, he was still working and on his feet all day.

Sedimentation Rate

In all cases the sedimentation rate was regularly tested. Some patients showed rapid improvement in this respect; in others progress was slower and it took eighteen months or two years for the sedimentation rate to approach normal; while in some, in spite of marked clinical improvement, very little change in the rate took place. Blood-sugar tests were also carried out, and more recently attention has been given to the plasma proteins and the albumin-globulin ratio. It was found that overdosage tended to reduce the blood sugar and to produce mild symptoms of hypoglycaemia, which were readily corrected by diet: sometimes the addition of diastase corrected this tendency by improving the starch digestion. No other untoward reactions of any moment have been observed.

Discussion

The beneficial effects observed as a result of the administration of the intestinal extract in rheumatic conditions differing in aetiology and pathology, such as rheumatoid and osteo-arthritis, would appear to indicate a common factor underlying all, and to support the idea, which was generally accepted by earlier workers in this field, of a rheumatic diathesis. This rheumatic diathesis may perhaps be defined as a constitutional state of the tissues, inherited or perhaps acquired, as a result of which such tissues are more vulnerable to the action of toxins, bacterial invasion, or trauma, and the ill effects of which are further aggravated by defects in intestinal digestion and assimilation.

Alteration in the relative proportions of certain protein molecules in the blood serum is a feature of rheumatoid arthritis and is met with also in some cases of osteo-arthritis. The normal ratio of albumin to globulin is about 4 : 1, the globulin molecules being about twice the size of the albumin molecules. In rheumatoid arthritis this ratio is altered to 2 : 1, 1 : 1, or even 0·75 : 1, which is assumed to be due to some breaking down of tissue to a greater degree than normal, to more globulin molecules being absorbed into the blood stream from the gut, or to absence of the normal mechanism, an enzyme or some unknown factor which may break down these large globulin molecules into the smaller albumin molecules. Whether this change in the blood proteins is a stage in the development of the disease or a result of the disease is at present a matter of speculation. It is known that erepsin is present normally in the blood, the kidneys, and other tissues, and that it is absorbed from the site of manufacture, the wall of the intestine, small or large; and the theory is submitted that this enzyme in the blood is a factor in the maintenance of a balanced proportion of proteins. Space will not permit of an elaboration of this hypothesis, although a considerable amount of experimental evidence is available and it was partly with this in view that the treatment was adopted. The presence of an undue proportion of the large globulin molecules alters the rate of dialysis of plasma through certain membranes, such as the ciliary fringes of the synovial membranes ; and investigation of the synovial fluid from this aspect is a matter worthy of further research.

The part played by allergy in some rheumatic diseases deserves consideration in the problem of the possible mode of action of this method of treatment. It has been held that the insidious and slowly developing processes of chronic rheumatism may be due to the continued influx of incompletely digested protein fragments into the blood stream, which act as antigens against which the antibody content of the circulating blood is low. The antigen-antibody reaction takes place within the cells with subsequent anaphylactic inflammation, the condition being described as allergic. The theory of protein allergy has the support of many workers in this field, one of whom, Gudzent (1940), was able to produce rheumatic tissue lesions in animals by various types of proteins, and observations on patients indicated that food proteins (animal as well as vegetable) are chiefly responsible. They produce

under certain conditions antibody-antigen or allergic reactions, with their cytotoxic effects on the connective tissues, and thus lead to rheumatic tissue lesions.

All these suggested explanations of the mode of action of intestinal extract may be wrong, in part or entirely, but the fact remains that the application of the treatment in practice has given ample proof of its efficacy in a very large number of patients. Thus, no one to-day doubts the value of the Wassermann reaction, although its original premises were quite different; and no one denies the efficacy of liver or stomach extract in pernicious anaemia because the mode of action is still largely unknown. It is scarcely reasonable to expect that administration of an organ extract would have an effect upon a disease unless it stands in some relationship to the cause of that disease. The same argument may, therefore, apply if the symptoms of rheumatic disorder are alleviated markedly by the administration of an intestinal extract. If it does not stand in any aetiological relationship it is difficult to see how administration could possibly produce any improvement. After seven years' intensive application of this therapy, the writer has met with numerous instances in which its application has yielded as typical a response as could be desired. The nature of bone change is, however, so variable in the different cases presented for treatment that, however much the disease may be arrested, anatomical conditions alone prevent a return to normal in many instances. The importance of assessing the relationship lies in the possibility of preventing the devastating changes in the young and middle-aged with relatively slight risk to the sufferer.

Some Points in the Treatment

As would be expected, the longer the duration of the disease the longer will be the " lag " before improvement is observed. A patient who has had rheumatoid arthritis for only three months or so will usually begin to improve within about two months; three months may be regarded as the minimum period for the average case of two to five years' duration, whilst those with a disease of longer duration may require to be treated for six or twelve months before improvement in the rheumatic condition becomes obvious. Nevertheless if treatment is persistently maintained this class of case will show definite response in due course. The general health of the patient improves often beyond all recognition, weight is gained, and constipation, so common in these cases, often disappears; and these effects often precede improvement in the purely rheumatic symptoms. A maintenance dose is often required for years after the disease has apparently died out. The same holds good in most other conditions of deficiency, e.g. pernicious anaemia, diabetes, and hypothyroidism. Clinical evidences of this have been met with frequently in patients who have relapsed on stopping treatment and who have improved again when the intestinal extract was resumed.

It is important to maintain an adequate protein intake in the diet, and this should be spread as evenly as possible over the three main meals of the day. A high protein diet is complementary to intestinal extract treatment. Attention to

carbohydrate digestion is important. Purgatives should be avoided as far as possible. Blood-sugar estimations should be carried out regularly, and symptoms of hypoglycaemia watched for and treated by dietetic measures, and by alteration of the dose of intestinal extract.

Summary

1. A large series of post-mortem examinations have shown atrophy of the small intestine to be marked in patients with rheumatic disease.

2. The effect of administration of an extract of small intestine mucosa is described, the mode of action discussed, and certain conclusions submitted to the effect that dysfunction of the secretory activity of the small intestine is an important factor in the aetiology of rheumatoid arthritis and allied conditions.

The writer wishes especially to acknowledge with sincere thanks the great help given by Dr. Reginald Ellis, F.R.C.P., Dr. C. W. Buckley, F.R.C.P., the laboratory and radiological staffs concerned—Mr. B. D. Thornley, B.Sc., and Mrs. Thornley, B.Sc., in particular—and also the Regional Officers of the Ministry of Health for much help regarding extension of laboratory facilities during war time.

REFERENCES

Bray, G. W. (1937). "Recent Advances in Allergy." London. Quoted in *Brit. med. J.*, 1946, **1**, 594.
Clark, A. J. (1921). *J. Pharm. exp. Therap.*, **16**, 415.
Cori, C. F., and Goltz, H. L. (1925). *Proc. Soc. exp. Biol., N.Y.*, **23**, 122.
Gudzent. F. (1940). *Med. Welt*, **14**, 545.
Jackson, C. M. (1925). "The Effects of Inanition and Malnutrition upon Growth and Structure." Philadelphia.
Laughton, N. B., and Macallum, A. Bruce (1930). *Canad. med. Assoc. J.*, **3**, 348.
Looney, J. M., and Walsh, A. I. (1939). *J. Biol. Chem.*, **130**, 635.
Magee, H. E. (1945). *Proc. roy. Soc. Med.*, **38**, 389.
Martin, C. P., and Banks, J. (1940). *J. Anat.*, **75**, 135.
Putnam, T. J. (1923). *Amer. J. Physiol.*, **63**, 548.
Starling, E. H. (1909). "Fluids of the Body", p. 49. London.
Sun, T. P. (1927). *Anat. Rec.*, **34**, 341.

(*For Illustrations to this Article see following pages*)

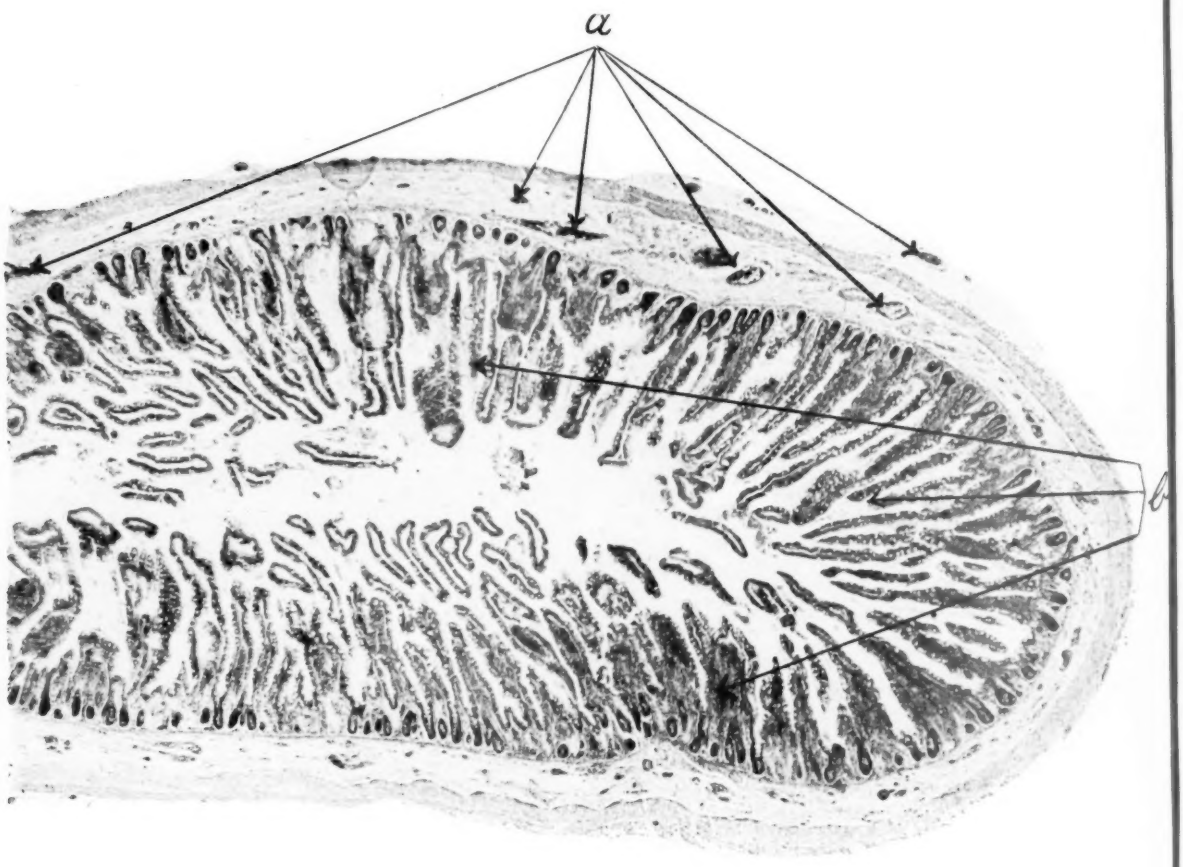


FIG. 1.—Transverse section of the small intestine of a child, aged 3 weeks, × 33, showing (a) ample vascular supply, (b) rich mucosa.

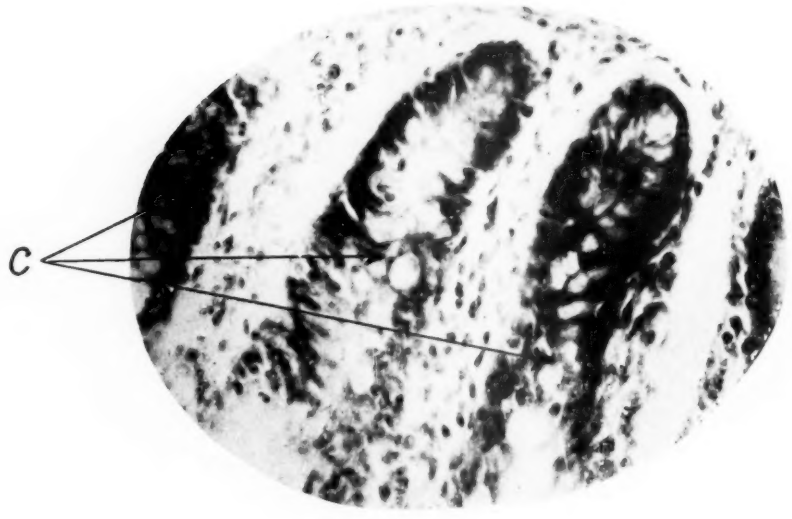


FIG. 2.—As above but magnified × 320 to show (c) secreting glandular epithelium with well-stained nuclei around acini.

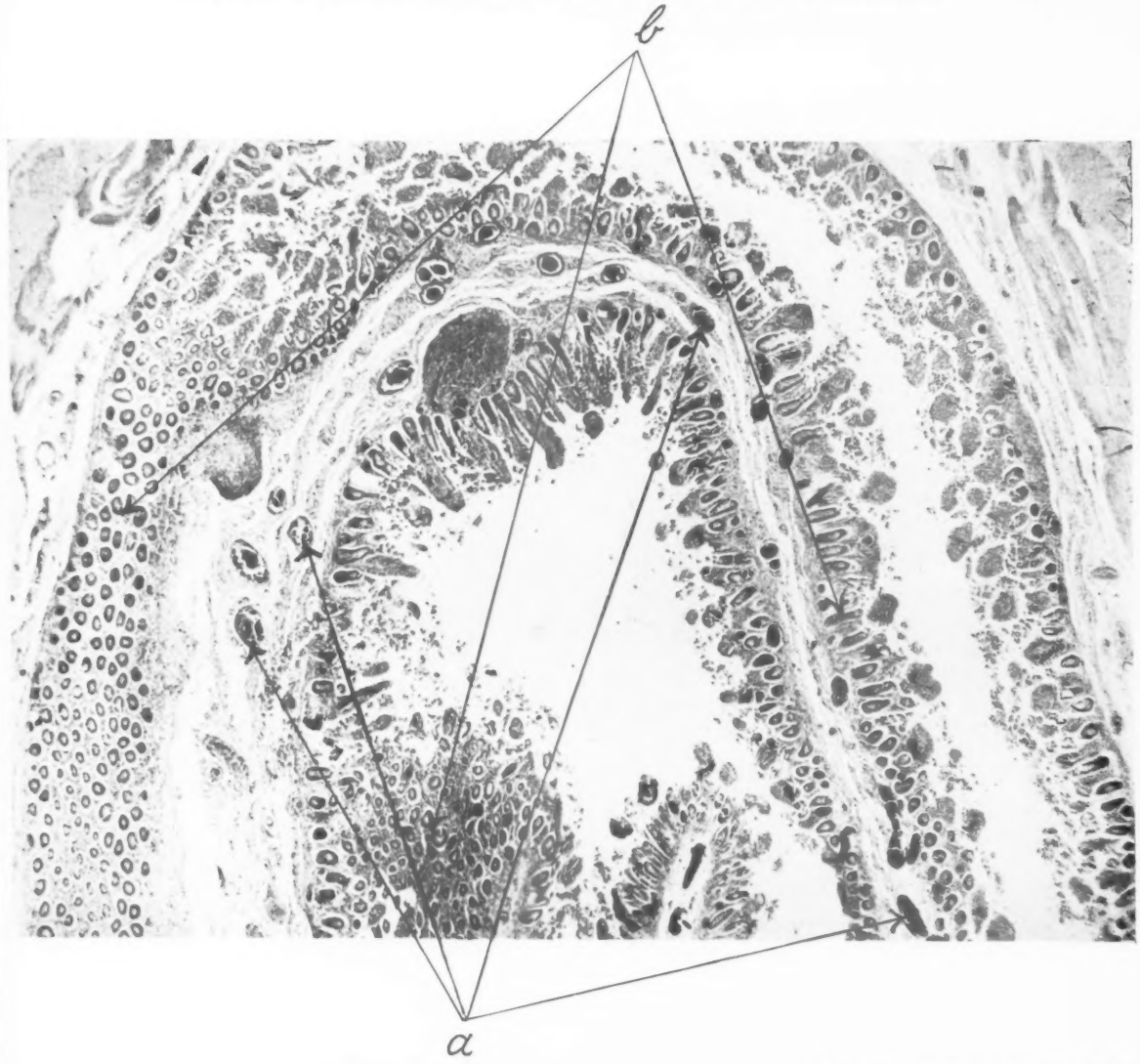


FIG. 3.—Transverse section of the small intestine of an adult male, aged 50, showing (a) ample vascular supply, (b) rich mucosa.

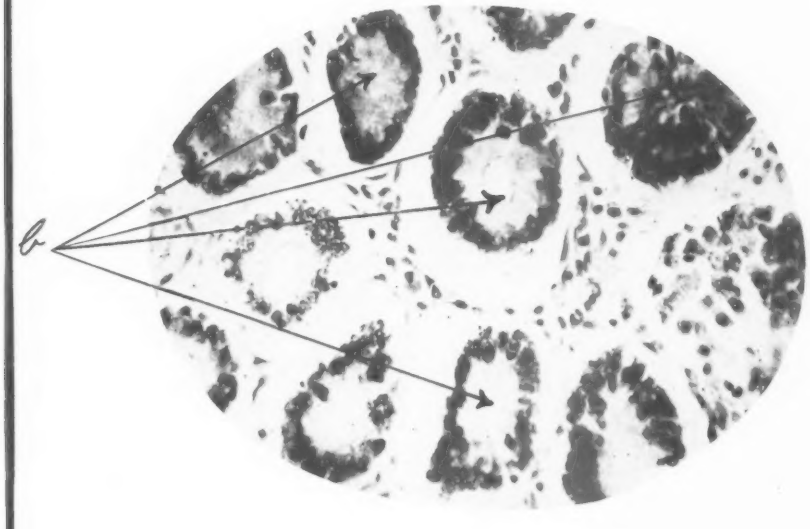


FIG. 4.—As in Fig. 3 but magnified × 320 to show regular arrangement of glandular acini with nuclei well stained all round acinus, (b).

FIG. 5.—Transverse section of small intestine from a case of rheumatoid arthritis of intermediate degree of severity. The vascular supply is not so good. The whole mucosa is not so thick as in normal, and acinar formation is very poor in some areas (b).

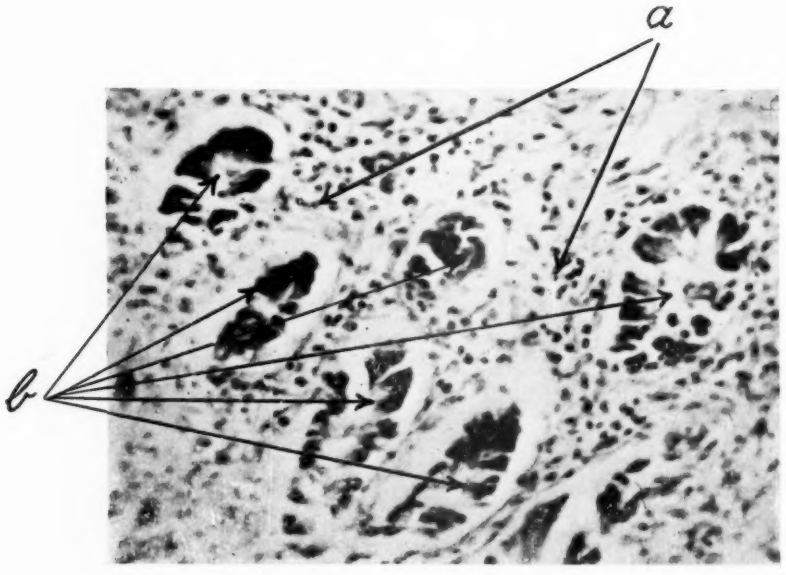


FIG. 6.—As in 5 but magnified × 320. Shows increase of inter-acinar tissue (a) and commencing degeneration (b) of glandular acini.

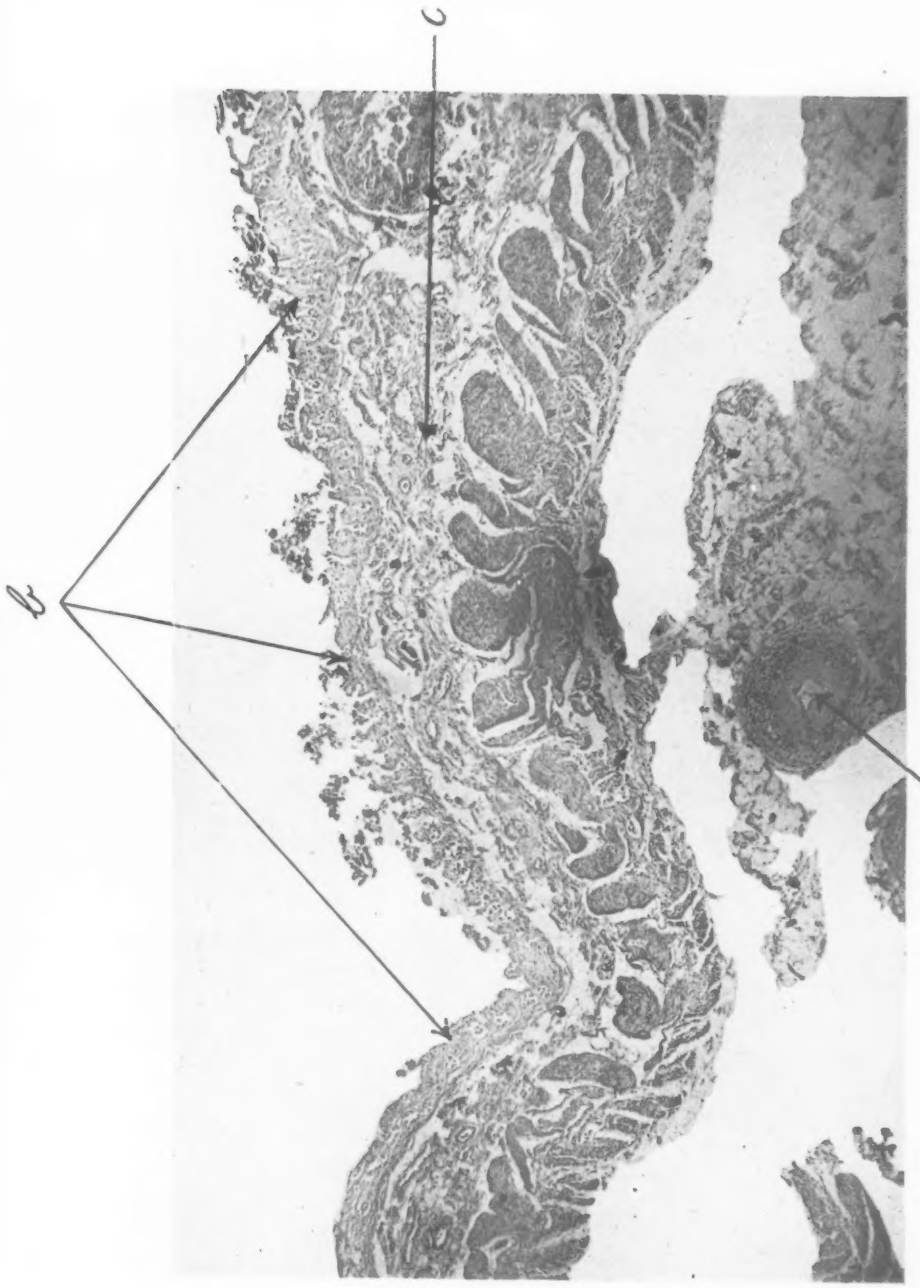


FIG. 7.—Section of small intestine of very advanced rheumatoid arthritis case. Bedridden for years and extremely emaciated, (a) shows extreme degree of endarteritis of branch of mesenteric artery—restricting blood supply in the intestine; (b) gross denudation of mucosa—only a few tags of glandular material being left; (c) fibrosis shown by selective staining in this zone.

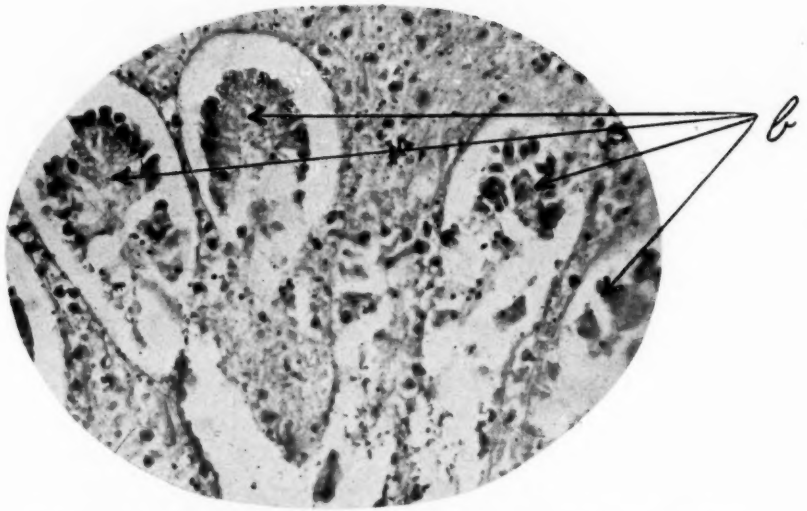


FIG. 8.—As Fig. 7 but magnified × 320 to show glandular epithelium disorganized at (b) taken at higher level than Fig. 9.

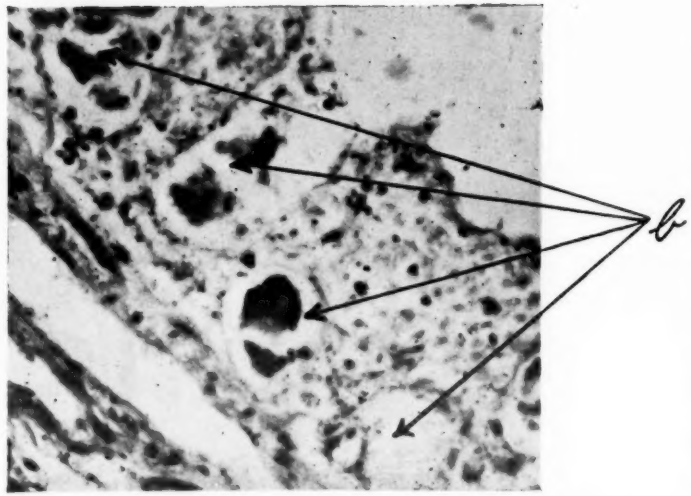


FIG. 9.—Taken at lower level in intestine, which also shows degenerating acini (b) × 320.

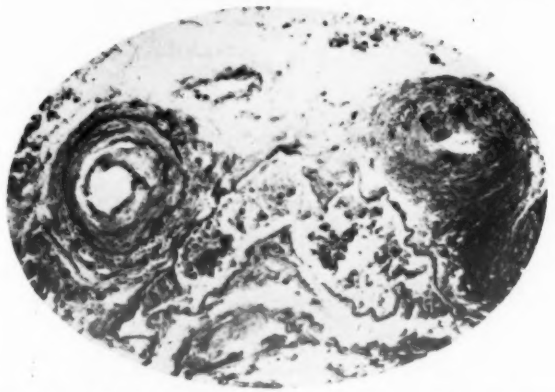


FIG. 10.—Same advanced case of rheumatoid arthritis to show further examples of extreme endarteritis.

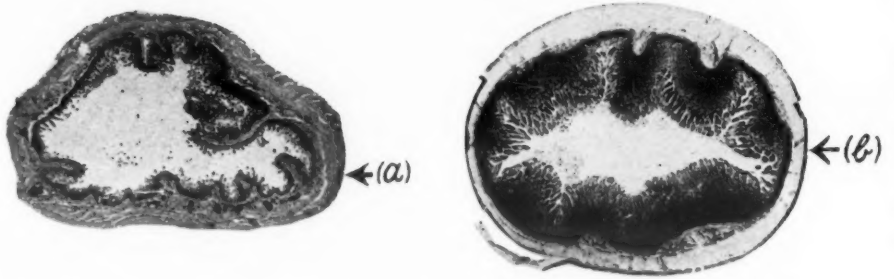
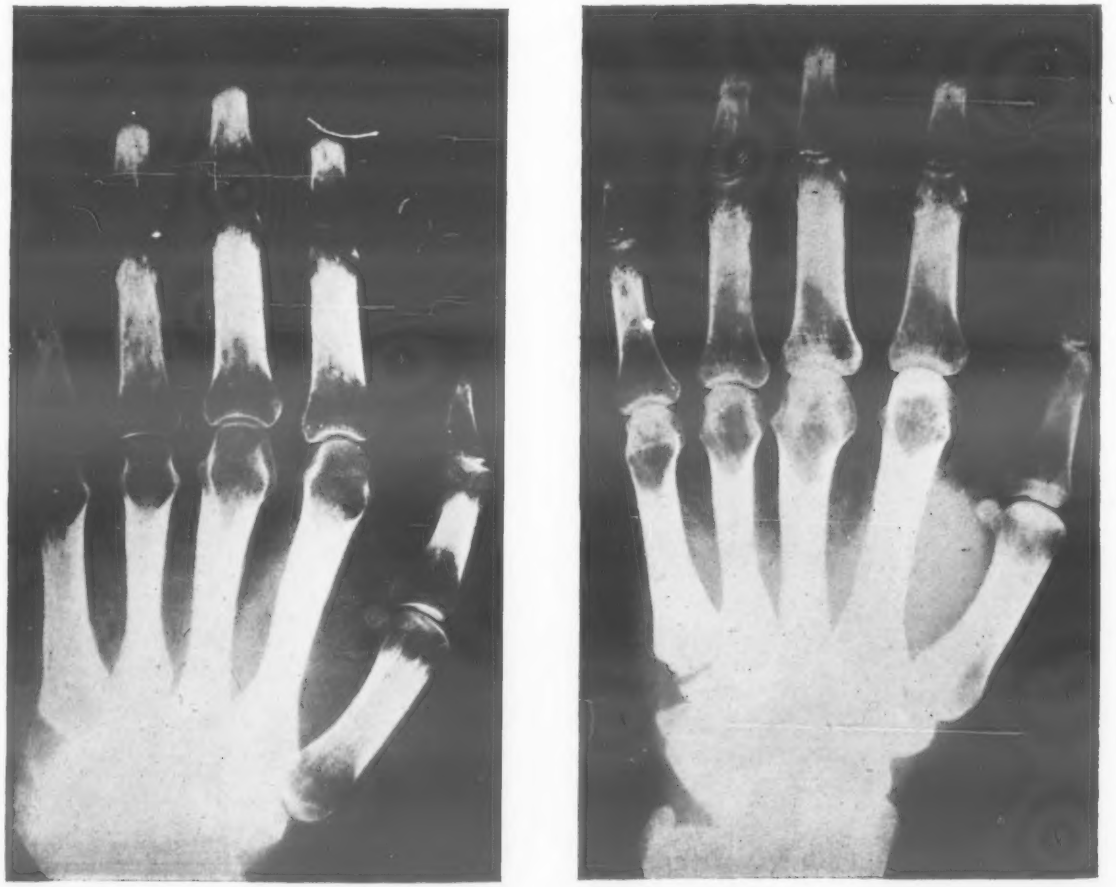


FIG. 11.—Shows complete transverse sections of small intestine of (a) very advanced case of Paget's disease with gross skeletal changes (note thin mucosa and hypoplasia, × 5), (b) cat's intestine—same magnification as (a), × 5 (note wealth of mucosa).

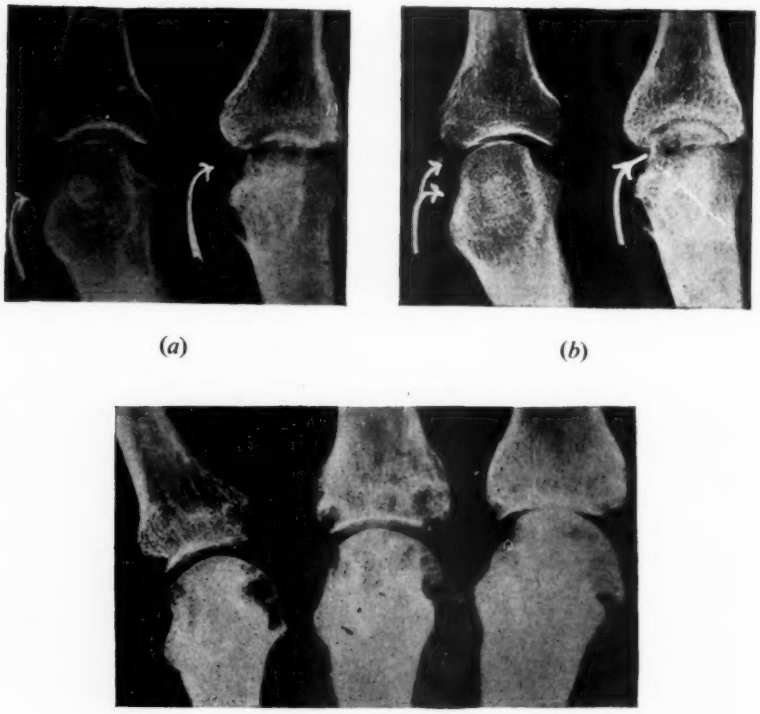


(*a*) (*b*)

FIG. 1.—Rheumatoid arthritis. (*a*) Radiograph taken in 1936, showing generalized osteoporosis with predominance in vascular spongiosa at the ends of the bones. (*b*) The same case one year later, showing generalized osteoporosis with recovery of the normal contrast between the ends and shafts of the bones.

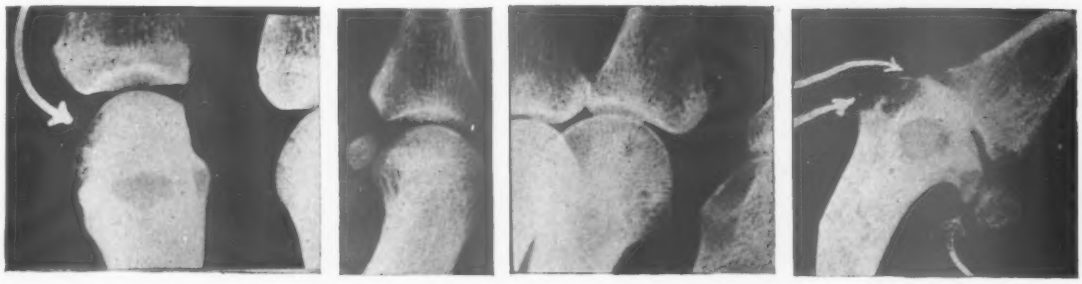
(*a*) (*b*) (*c*)

FIG. 2.—Examples of active changes of rheumatoid type from standard radiographs of the hands. (*a*) Generalized osteoporosis with a local pattern in the more vascular areas. (Corrected suspension stability 65%; blood uric acid 3·8 mg. per 100 c.cm. of blood; history, one year.) (*b*) Local osteoporosis of articular cortex due to subchondral invasion by granulation tissue. (*c*) Erosion at an articular margin, showing a local osteoporosis of the eroded trabeculae and of the adjacent articular cortex. (Corrected suspension stability 59%; plasma uric acid 5·7 mg. per 100 c.cm. of blood; history, two years.) An oblique projection was required to show this erosion in profile.



(*a*) (*b*) (*c*)

FIG. 3.—Changes during quiescence of the local joint involvement in rheumatoid arthritis. (*a*) Marked erosion of one joint and early local osteoporosis of the cortex in another. (*b*) Same case one year later, showing repair and buttressing, with cystic enclosure in the eroded joint, while erosion and loss of cartilage had proceeded in the others. (*c*) Three joints, deformed by rheumatoid arthritis, in the stage of local quiescence which simulates gout. (Male, 47 years, corrected suspension stability 61%, plasma uric acid 4·4 mg. per 100 c.cm.; muscle section, rheumatoid arthritis history, ten years.)



(*a*) (*b*) (*c*) (*d*)

FIG. 4.—Examples of changes of gouty type from standard radiographs of the hands. (*a*) Zone of local translucency under the articular cortex. (*b*) Local translucency at the articular margin. (Plasma uric acid, 8 mg. per 100 c.cm.) (*c*) Chiselled-out trabeculae in small endosteal tophus. (The presence of sclerosis from osteoblastic activity indicates inactivity of the biurate deposit and commencement of the walling-in process.) (Woman, aged 53 years; corrected suspension stability 97%.) (*d*) Subarticular tophus showing articular cortex of normal density projecting over the translucent area. (Male, 53 years; corrected suspension stability 70%; plasma uric acid 8 mg. per 100 c.cm.; history, nine years.)

FIG. 5.—Multiple tophi showing examples of chiselled-out trabeculae, a larger tophus with crenated outline, a walled-in tophus or cyst, destruction of cartilage, and osteophytic formation. (Woman, corrected suspension stability 78% to 95%; blood uric acid 2 to 4·5 mg. per 100 c.cm. of blood; history of remissions.)

FIG. 6.—Honeycombed appearance in one bone, and multiple small tophi in another. (Male; corrected suspension stability 85%; plasma uric acid 6·1 mg. per 100 c.cm.; history, four years.)

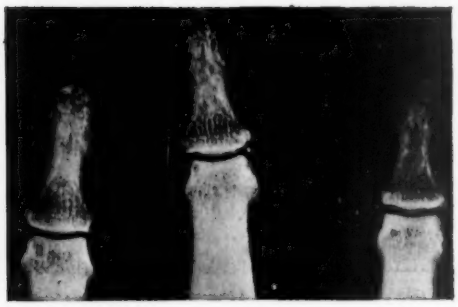


FIG. 7.—Osteo-arthritis, showing ossicles in the region of the capsule of the terminal joints of the fingers. (Corrected suspension stability 89% ; history, seven years.)

FIG. 8.—Example of Heberden's node, with true hypertrophy at the base of a terminal phalanx, together with loss of cartilage, osteosclerosis, and pitting of the articular surface. (Corrected suspension stability 88% ; plasma uric acid, 5 mg. per 100 c.cm.)

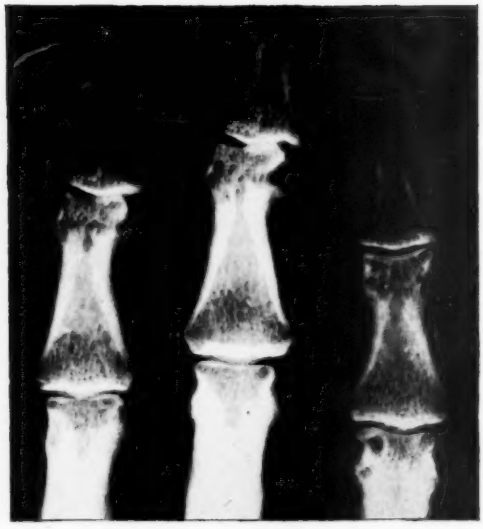
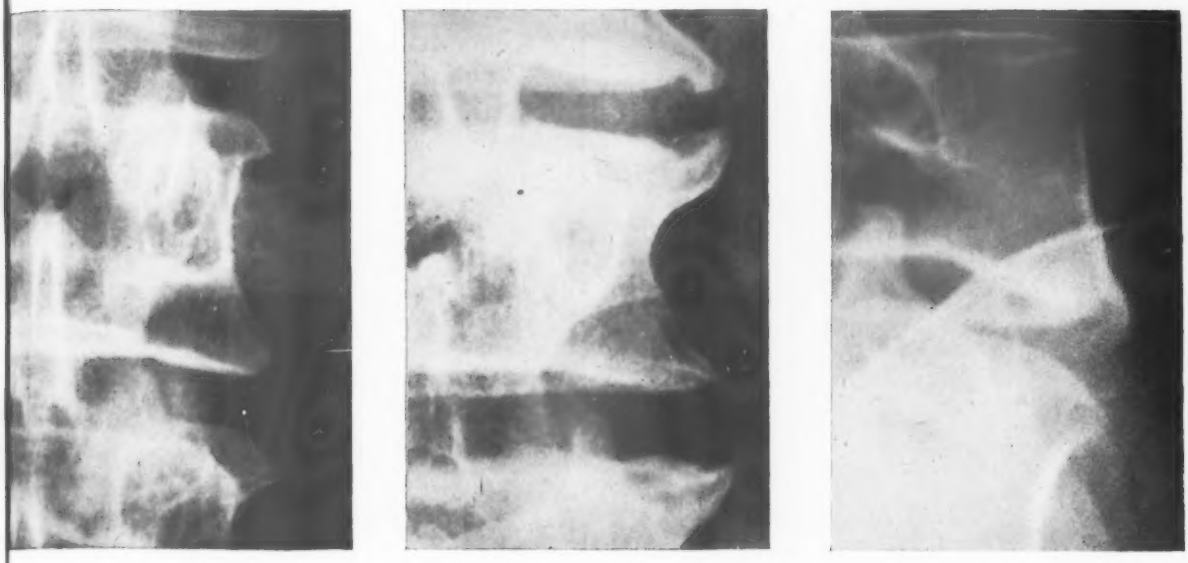


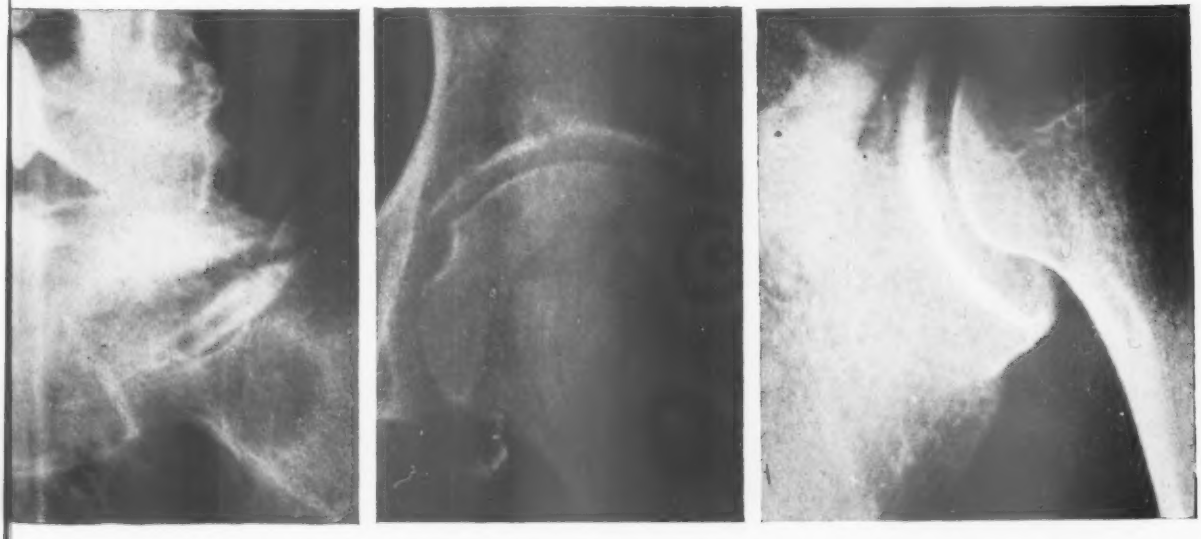
FIG. 9.—Pseudo-cystic changes in osteo-arthritis simulating gout. (Male, 51 years; corrected suspension stability 83% ; plasma uric acid 4·4 mg. per 100 c.cm. ; history, three years.)

FIG. 10.—Osteo-arthritis in cervical spine, showing diminution of cartilage and osteosclerosis, with lipping in the plane of the joint. An ossicle in the region of the capsular ligament is also demonstrated. (Male, 68 years; corrected suspension stability 67% ; blood uric acid 4·4 mg. per 100 c.cm. of blood ; history, two years.)



(*a*) (*b*) (*c*)

FIG. 11.—Osteophytes due to strain of the capsular ligaments without loss of articular cartilage. (*a*) Origin of lipping shown in the region of capsular attachments close to the articular margin. (*b*) Osteophytes following the line of the capsular ligaments and forming incomplete osseous bridging across the joint. (Male, 69 years; corrected suspension stability 86%; blood uric acid, 3·2 mg. per 100 c.cm. of blood; history, one year.) (*c*) The fringe character of these osteophytes is demonstrated in this radiograph. Shadowing is usually reproduced only where the thin fringe is in the line of the rays at the outer margins. (Female, 46 years; corrected suspension stability 89%; history, two years' sciatica.)



IG. 12.—Osteophytes extending outwards in the plane of the joint in compensatory fashion, with associated loss of articular cartilage and osteosclerosis. (Woman, aged 63 years; corrected suspension stability 85%; blood uric acid, 1·8 mg. per 100 c.cm. of blood; history, one year.)

FIG. 13.—Pseudo-cystic formation in the main weight-bearing area of the acetabulum without associated loss of articular cartilage. (Woman, aged 63 years; corrected suspension stability 85% blood uric acid, 1·8 mg. per 100 c.cm. of blood; history, one year.

FIG. 14.—Calcification in labrum glenoidale of the shoulder joint, where osteoarthritic changes are usually less marked than in the hips and knees.

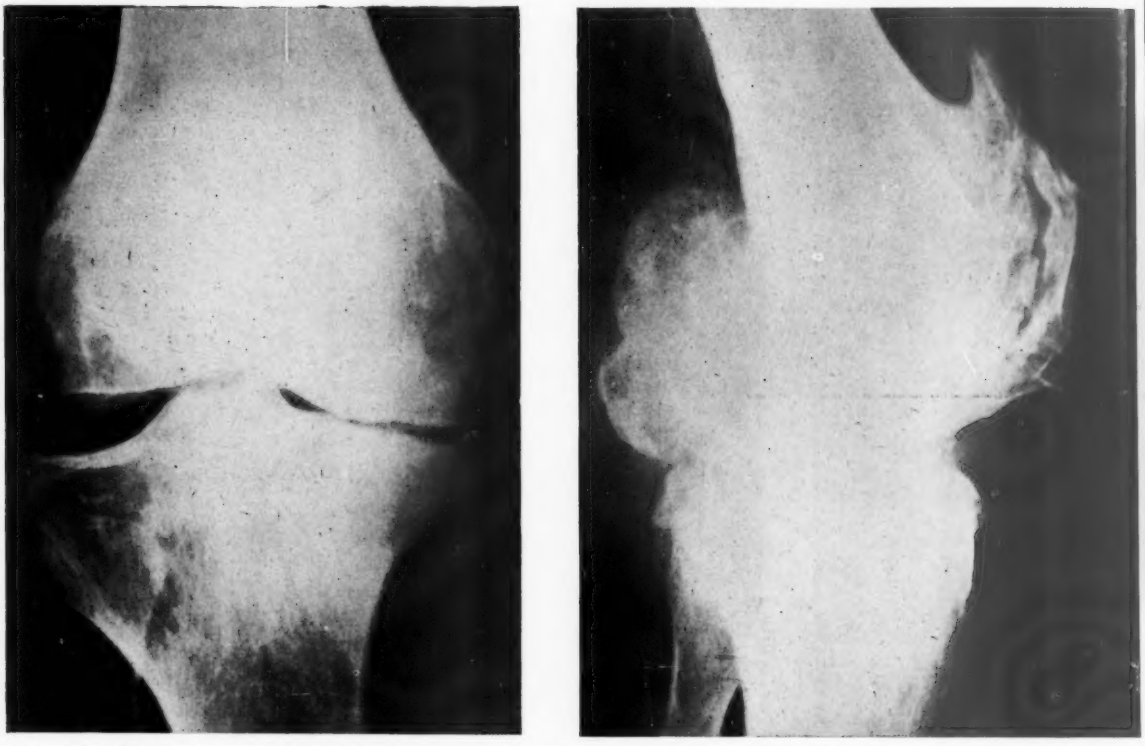


FIG. 15.—Marked osteo-arthritis in the knee joint showing (*left*) uneven loss of cartilage ; and (*right*) gross osteophytic formation of organized type. (Woman, aged 54 years ; corrected suspension stability 78% ; history of pain after menopause, ten years.)

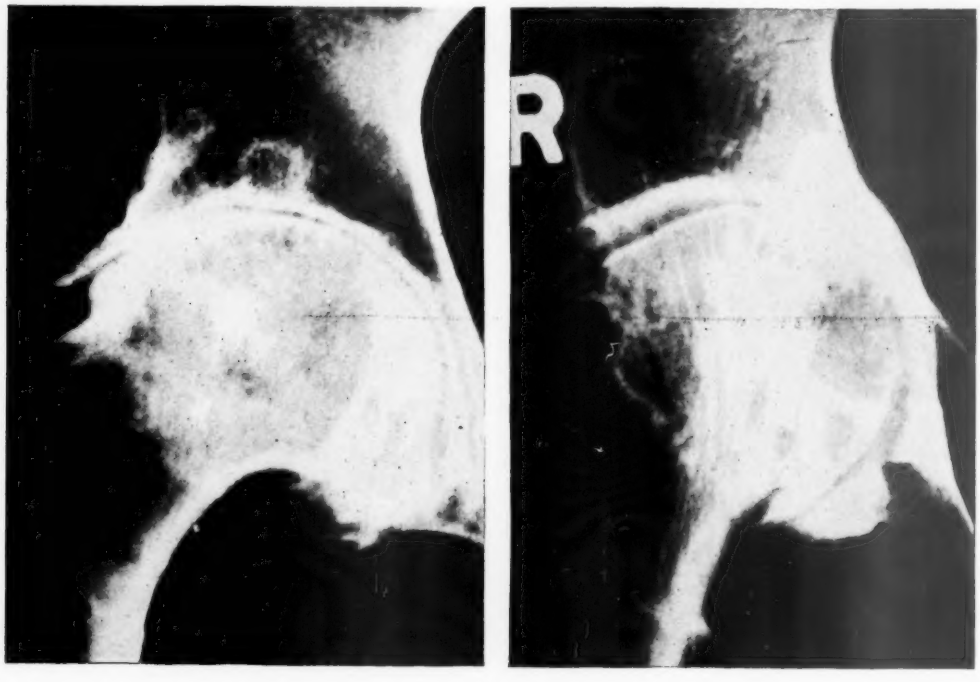


FIG. 16.—Osteo-arthritic changes in hip joint, of secondary type with spiky lipping and uniform loss of cartilage. (Corrected suspension stability 67% ; with thirteen years' history of rheumatoid arthritis.)

FIG. 17.—Osteo-arthritis in the hip joint, secondary to protusio-acetabuli. (Woman, aged 56 years; corrected suspension stability 86% ; history, two years.)

(*a*)

(*b*)

FIG. 18.—Case of rheumatoid arthritis with involvement of spine. (Corrected suspension stability 81% ; blood uric acid 4·4 mg. per 100 c.cm. of blood ; history, 15 years.) (*a*) Local changes in the interarticular joint between the second and third cervical vertebrae. (*b*) The same case, showing ankylosis in the affected joint four years later.

FIG. 19.—Multiple joint involvement in the cervical spine due to ankylosing spondylitis. (Man, aged 32 years ; corrected suspension stability 57% ; blood uric acid 3·8 mg. per 100 c.cm. of blood.)

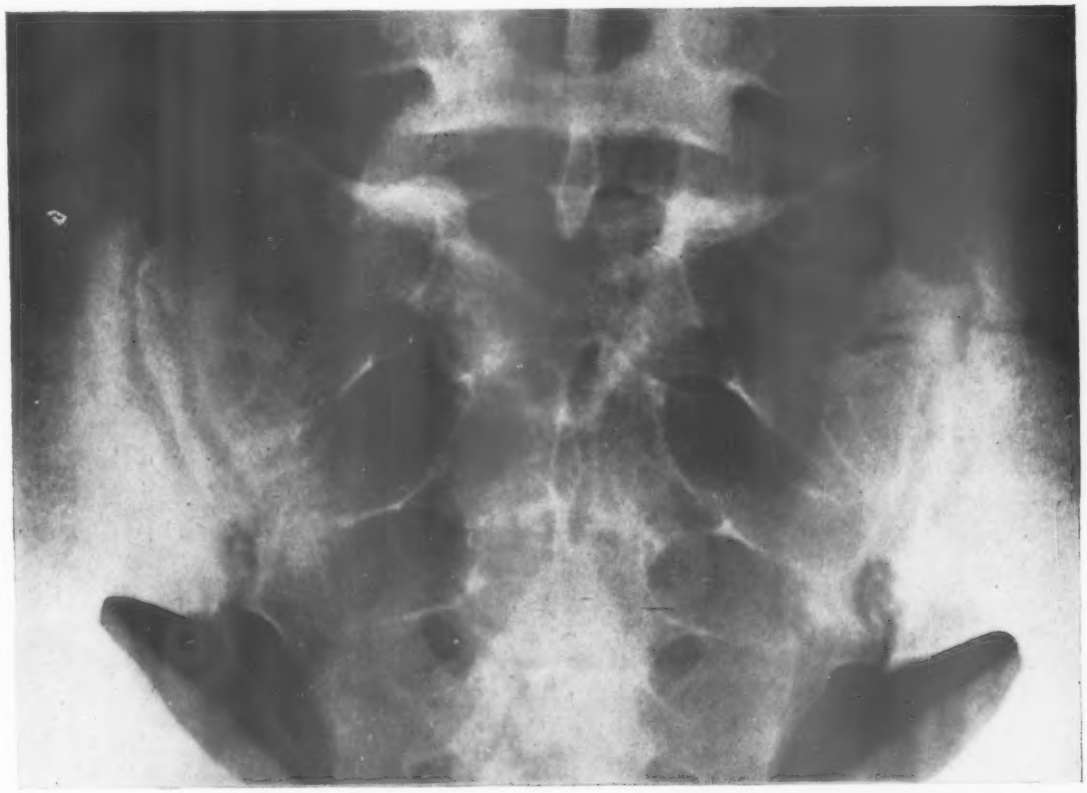


FIG. 20.—" Mobilization of calcium " in the subarticular zone of the sacro-iliac joints, offering presumptive evidence of ankylosing spondylitis. In addition to this, the cortical outline of the upper portion of the left ala of the sacrum has disappeared. (Woman, aged 31 years ; corrected suspension stability 68% ; history, four years.)

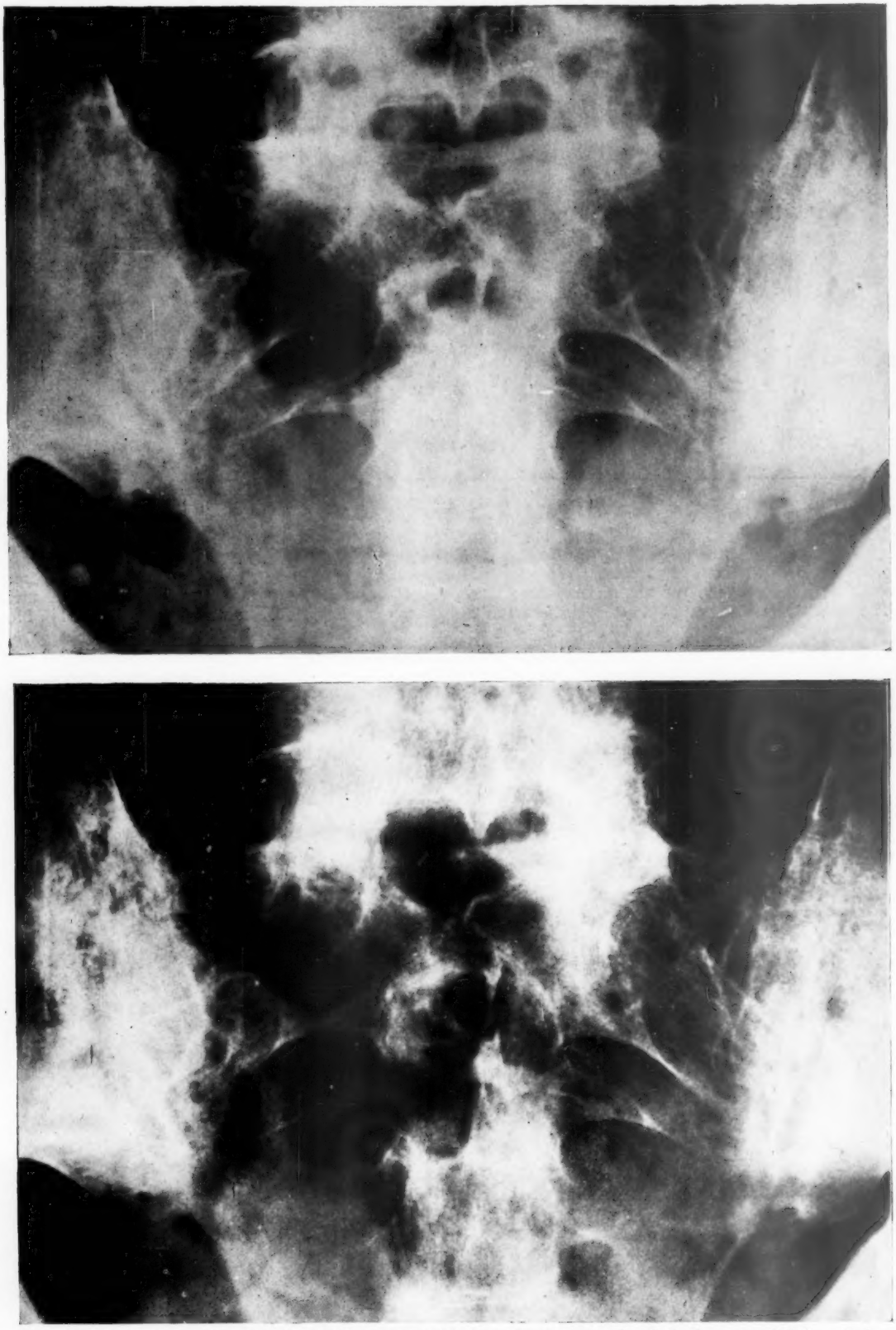


FIG. 21.—*Above*, zonal sclerosis, similar to Fig. 20, in a frank case of ankylosing spondylitis. *Below*, the same case nine months later, showing increase of the osteoporosis in the sacrum and iliac bones, with diminution of calcium in the opaque subarticular zones. (Man, aged 36 years ; corrected suspension stability 66% ; plasma uric acid 6·1 mg. per 100 c.cm. ; history, two years.)

FIG. 22.

FIG. 23.

FIG. 22.—Ankylosing spondylitis with early bamboo appearance in the lumbar spine. The bony ankylosis follows the line of inner capsule or cartilage border, as compared with bridging of osteo-arthritic type. (Man, aged 26 years ; corrected suspension stability 70% ; plasma uric acid 2 mg. per 100 c.cm. ; history, ten years.)

FIG. 23.—Example of well-organized "tram lines" showing in an oblique projection of the lumbar spine. (Man, aged 31 years ; corrected suspension stability 73 to 92% ; blood uric acid, 3·4 mg. per 100 c.cm. of blood.)

FIG. 24.—Ankylosing spondylitis at a late stage, showing orderly arrangement of trabeculation in the line of greatest stress across a hip joint. (Man, aged 33 years ; corrected suspension stability 80 to 60% ; blood uric acid, 3 mg. per 100 c.cm. of blood.)

FIG. 25.—Case of Paget's disease, showing coarse irregular trabeculae together with increase in the width of the inter-trabecular spacing. The cortex is involved, and slight buttressing is seen at the concave border of the tibia. (Man, aged 52 years ; corrected suspension stability 79% ; blood uric acid, 4·2 mg. per 100 c.cm. of blood ; plasma phosphatase, 20 units ; Wassermann and Kahn negative.)

FIG. 24.

FIG. 25.

PSYCHOSOMATIC NON-ARTICULAR RHEUMATISM

BY

E. P. EDMONDS

It seems now to be fairly widely agreed that emotional factors are relevant to the study of rheumatism, and particularly of non-articular rheumatism or fibrositis. The Horder Report (1941) stated that " Worry, anxiety, mental shock, can be often recognized as promotive of rheumatic disease ". The relationship is perhaps more often expressed as a matter of differential diagnosis between muscular pains of psychoneurotic origin and what is described as " true rheumatism ". But quite apart from psychological considerations, there is much controversy as to what constitutes " true " non-articular rheumatism.

Non-articular Rheumatism in General

Much of the present controversy lies broadly between the exponents of " fibrositis " as a precise clinical and pathological entity and those, more sceptical, who recognize only a vaguer collection of conditions better described as " myalgia ". The word rheumatism has the advantage of its wide recognition by doctors and patients in the description of a certain type of pain, usually with some stiffness and tenderness, of muscle and related fibrous tissue. According to a recent definition (Annotation, *Brit. med. J.*, 1946) the word rheumatism " by derivation implies the defluxion of a morbid humour to the part—that is to say, a local tissue change ". While postulating a local tissue change, however, the word is non-committal with regard to the precise nature of this change.

Possible Causative Factors

Some of the factors generally thought to be concerned in the production of non-articular rheumatism are as follows:

(*a*) chill from draughts, damp, or excessive sweating;

(*b*) trauma or strain, acute, as the " crick in the neck " or chronic, as gardeners' lumbago; fatigue from excessive or unaccustomed exercise, or from postural abnormalities such as kyphosis or flat feet;

(*c*) infection: acute, as in influenza, sandfly fever, rubella, or many other infections; or chronic, from a focal sepsis;

(*d*) irritation of nerve roots by tumours of the cord or prolapsed intervertebral disc;

(*e*) general metabolic disorder, such as gout;

(*f*) endocrine disorder, such as hypothyroidism and possibly hypopituitarism;

(*g*) increase of fibrous tissue, e.g. the susceptibility to rheumatic pains of scar tissue in old injuries, the tendency to " stiffness " in old age, and possibly also the increase of fibrous tissue as a result of previous rheumatism.

Some of these are external and environmental, others internal and individual factors. They may act in combination, so that an attack of non-articular rheumatism may be due to an environmental agency acting on an individual constitution which is predisposed to rheumatism either by hereditary endowment or by acquired bodily changes due to the effects of either the same or of other environmental agencies in the past. That two or more of these factors, internal and external, are involved is often suggested clinically by the fact that the same environmental cause may affect different individuals in different ways, or the same individual in different ways on different occasions.

Possible Mechanism of Local Tissue Change

Elliott (1944), by electromyographic studies in muscles supplied by nerve roots irritated by prolapsed disc or spinal tumour, found that tender spots consisted of small groups of muscle fibres in involuntary spasm, and said that " muscle spasm is considered to play a part in what may, for convenience, be called the rheumatic myalgias as well as the less common root syndromes ". He suggested also that sustained contraction of muscle impedes intramuscular circulation, and that the consequent anaemia may lead to fibrosis. Copeman (1943) suggested that acute infections like influenza may leave a legacy of latent " myalgic spots " which may later be activated by secondary factors, such as chill, to provide an attack of rheumatism. Copeman and Ackerman (1944), as a result of both biopsy and necropsy observations, reached conclusions " which seem to explain certain cases of fibrositis of the back, and it is believed, elsewhere ". They considered that certain areas of fatty tissue were particularly affected, becoming oedematous and congested under the influence of chill, toxaemia, etc., forming small herniae through fibrous tissue, which may then become chronically strangulated and form tender nodules. They stated that such changes probably represented a comparatively advanced stage in the process, and that " to explain the minor and less localized degrees of fibrositis almost universally experienced at one time or another we need not postulate actual herniation of the fat tissue ". Lewis (1938) has shown the constancy of the quality of muscular pain as a result of such varying stimuli as limitation of the circulation, electrical stimulation, injection of isotonic acid solution, hard squeezing, or light pressure on a muscle

previously fatigued. Kellgren (1938) showed that pain from muscle is always diffuse, and often referred, the referred pain being associated with referred tenderness of deep structures. Kelly (1945) described this diffuse pain and tenderness as being due to reflex nervous impulses from myalgic spots occurring at particular " sites of election " at musculo-tendinous junctions. In a later paper (1946) he suggested that these myalgic spots were themselves largely due to reflex nervous influences.

There may be more than one mechanism of production of rheumatism in muscle and fibrous tissue, and it seems still more likely that there are different stages in the process, so that the actual tissue changes may vary according to the aetiological factors, their combination, their severity, or their length of duration, but may produce the same symptoms in the patients, though with possible variations in the objective physical signs.

Published Observations on Psychological Factors in Relation to Non-articular Rheumatism

In an analysis of morbidity statistics among insured patients, Halliday (1935, 1938) stated that 40% of those labelled rheumatism were suffering from psychoneurotic illness. The same author (1937) suggested that considerable insight into aetiology could be obtained by investigating many cases labelled rheumatism in terms of emotional reaction, of localized physical inferiority, either inherited or acquired, and of the symbolic representation of emotional attitudes by means of bodily symptoms (e.g. lumbago as a symbol of a " rigid independence "). Gordon (1939) drew attention to emotional derangement of autonomic imbalance, acting through the thalamic and hypothalamic centres, but also stressed symbolism as the basis of these symptoms, and wrote of the " hysterical simulation of rheumatism ". Hurst (1943), in what he described as an " essay in debunking " on the treatment of sciatica, gave examples of hysterical features; and Jackson (1943), in a very careful analysis of 100 cases of sciatica examined by expert neurologists, stated that " ruptured intervertebral disc, fibrositis, and neurosis are the three states of greatest importance in the causation of chronic sciatica in young people ". Fetterman (1940) described " vertebral neurosis ", in which he considered that long stretches of the erector spinae might be modified by emotional tension and produce symptoms, again symbolic in manifestation, such as the bent back inviting pity for one who cannot carry on under the laborious load of life. Hutchison (1942) found precipitating or aggravating psychological factors in 6 out of 54 cases of fibrositis, but distinguished these from *bona fide* fibrositis, and considered that two of the three signs—well-defined tenderness, spasm, or nodule-formation—must be present to establish this *bona fide*. Boland and Corr (1943) described as " psychogenic " approximately one-third of a series of 450 cases of disabling " rheumatic " conditions both of joints and muscles in United States soldiers. Heaton (1944) found that 26 out of 53 Canadian soldiers with joint

pains had no objective signs of disease but evidence of psychological disorder; non-articular rheumatic pains were described in 14 of these patients.

Ellman and others (1942), in a biographical study of 50 patients, described what they called " the psychodynamics of complaints mimicking true fibrositis ". They stated that a complaint of vague shifting pains was suggestive of underlying emotional disorder, while " strictly localized pain points to the presence of organic change ". Thirty-five of the 50 patients were found to have significant psychological disorders, and the ratio of those with localized pain to those with vague pains was smaller (13 to 22) in these patients than in the rest of the series (in which it was 13 to 2). Nevertheless 13 out of 35 patients in this series did have localized pain.

Flind and Barber (1945) found 42 cases of generalized muscular pains of psychoneurotic origin in a series of 120 patients investigated in a rheumatic centre in the Royal Air Force, and they described the condition as " not a physical one but entirely a psychogenic reaction ". Halliday (1944) considered that the onset or the recurrence of certain cases of " true fibrositis " might be precipitated by emotional upset. The general tendency, however, of many of the writers just quoted is to differentiate between the pains of psychoneurotic origin and those of " true rheumatism " or fibrositis.

Some Observations on Muscular Pains in Patients with Psychoneurosis

Many of the papers just quoted gave some estimate of the percentages of neuroses found in groups of patients presenting with rheumatic pains. The present investigation proceeds in the opposite way and deals with the prominence of muscular pains in a series of patients with psychoneurosis. It forms part of a survey of 183 adults with psychoneurosis seen in a general practice during four years. There was a wide variety in the presenting symptoms of these patients. Some had demonstrable structural lesions, such as peptic ulcers, but these were included only if there was strong evidence of an emotional factor in their production, and when there were also other symptoms and signs likely to be emotionally determined in the same patients. Against the background of the other complaints such lesions may appear to be mere episodes in the full context of the life history, just as the fixed furrows on a man's brow may be but one part of an apprehensive outlook on life. It seems of little value to classify these patients according to their symptoms, which are so varied and multiple. Terms such as " cardiac neurosis " are for this reason both useless and misleading. It is difficult also to state the presenting or predominant symptoms in individual patients, especially when these are observed over a fairly long period. This is perhaps especially noticeable in general practice as compared with hospital work—a longitudinal as compared with a cross-section view of the patient. It seemed of interest, however, to note the incidence of some of the commoner groups of symptoms found in the whole series.

Comparative Incidence of Some Symptom-groups in 183 Patients with Psychoneurosis

Muscular pains were described by 87 patients (47%); headaches by 72 (39%); gastro-intestinal symptoms (including 14 cases with peptic ulcers) by 70 (38%); subjective mental symptoms, described as depression, anxiety, or nervousness, by 49 (27%); insomnia by 32 (17%); skin complaints by 29 (16%).

The 87 patients with muscular pains included some in whom these pains were the chief, and in some cases the only complaint when first examined, and all these had some degree of muscular stiffness and tenderness. In most of the patients the muscular pains were accompanied by the other symptoms. Many who described these pains as part of their previous history said that their muscles had been stiff and tender at the time. In others the description was more vague, but in these the attacks were either frequent or prolonged.

Other Complaints with which Muscular Pains were Associated

Symptoms most commonly found, either coincident or more often in sequence with muscular pains, in the 87 patients were as follows: gastro-intestinal symptoms (including 7 with objective evidence of peptic ulceration), 43; headaches, 41; cardiovascular disorders, 39; skin complaints, 15 (psoriasis 6, alopecia areata 5, urticaria 2, pruritus vulvae 2); insomnia, 12. Other complaints in a smaller number of patients were tremors, sweats, dysmenorrhoea, and frequency of micturition.

Halliday (1943) has pictured as a " repertory of diseases " the tendency of certain affections to coexist or follow each other in the same patient, and fibrositis and duodenal ulcer were one of the associations he described. Copeman (1939) referred to the association " in a very large majority of cases " of fibrositis with dyspepsia, and also stated that " the type of patient with sciatica is the typical duodenal ulcer patient "; although he gave no evidence in support of these observations, they are significant in the present context, especially as he was not referring to psychological factors in this connexion.

The large number complaining of headaches suggests that some of them may have been of the rheumatic type described by Cyriax (1938) as due either to referred pain from cervical muscles or to changes in the aponeurosis of the scalp.

Site of Pain

Pain was described as being in the chest in 43 cases; in the lumbar region in 36; of sciatic distribution in 7; more vaguely described in the upper or lower limbs in 31; in the neck in 17. The pains were predominantly unilateral in 51 cases, in 44 of which they were mostly left-sided and in 7 right-sided. At least 2 of the 7 patients with predominantly right-sided pains were left-handed.

Note on Left Thoracic Pain

Twenty patients in the series complained of pain of the type sometimes described as praecordial or inframammary, but 12 of these also had rheumatic pains in other sites. Baker (1942), in a series of 52 patients with inframammary pain, found that the majority complained also of pain and stiffness elsewhere, but that these other pains were usually found only on enquiry, the " heart " pain having assumed most immediate importance in the patients' minds. Baker also described that 45% of these patients showed some tenderness on palpation. Wood (1941), investigating the left thoracic pain in " effort syndrome ", found this pain in 78% of a series of 200 cases. In 25% of these there was pain also on the right side of the chest, and 57% had pains described as " cramps " in other parts of the body. He described this pain as arising in local muscular and fibrous tissue. This pain is even sometimes described by writers as " pectoral fibrositis ", and Copeman (1939) affirms the presence of small tender nodules " in the praecordial area in certain cases of pseudo-angina ". From the clinical characteristics of this pain, and from its frequent association with pains on the right side of the chest and in other muscular regions, there seems, therefore, to be good evidence to suggest that it may be grouped with the other muscular pains under consideration.

Three Case Histories

Case 1

A farm-labourer of 35 for eight years had frequent and long periods of incapacity from lumbago, sciatica, and pains in chest, limbs, and neck. The panel card repeatedly notes that the left side was most affected. At a time when the patient was away from work for over three months with lumbago, the muscles were very tender and stiff, but the lumbar and sacral vertebrae showed normal *x*-ray appearances. A prolonged course of radiant heat and massage in hospital resulted in little improvement. The man had a previous history of frequent abdominal pains, headaches, and tachycardia, and these complaints to some extent alternated with his rheumatism.

He had a surly, miserable expression and deeply furrowed brow, was very reserved, and at first stated that his only worry was his rheumatism. He later admitted great resentment against his employer, whom he accused of a bullying, overbearing manner. He would have liked to answer the employer back, but was afraid of losing his job, and also that his widowed mother, to whom he was much attached, might have to turn out of their cottage, which was tied to the farm. He seldom went to public houses or cinemas, and said he had no interest in girls. He showed much relief after discussing the problem of his work, and his resentful expression cleared for a time. But behind this current problem lay a much deeper antipathy to farm work. He said that he always disliked the work, but had to go on the farm in the first place because " it would be made unpleasant for his father " if he didn't (again owing to the tied house). His father had died very suddenly over eight years previously, and the son's illness began soon after this. He admitted that his father's death was a great shock to him, and he reproached himself that he did not say good-bye to him before he went to work that morning. But behind this reproach was a deeper sense of guilt, based on a great deal of antagonism to his father. In the words of an older sister, " he and father were not very good friends, you see father didn't like the way my mother spoiled him when he was a boy ".

Great improvement followed a change of work, and for the last two years he has lost no work by illness.

CASE 2

A married woman of 34 had a four years' history of rheumatic pains, and had had various forms of treatment, including analgesic local injections. The most persistent pains were in the lumbar region, but she also had pains in the shoulders, neck, and legs, and soreness, which she said she could " pin-point ", above the breasts. The left side was more affected than the right. She also complained of migrainous headaches, dysmenorrhoea, " palpitations " on slight exertion, constipation, lassitude, and depression.

She was vivacious and humorous, used to be athletic, and " hates to be beaten over anything " but since her rheumatism she could not lift weights and dared not garden. She had been married eight years, was relatively frigid, and coitus was now infrequent. She had a great fear of pregnancy, based largely on the warnings of her mother. " It seems a wretched thing to say, but she always seems to enjoy talking of the dangers of childbirth." The mother also exaggerated the moral dangers besetting her daughters as girls: " Never trusted us when we were courting." The patient had a very strong affection for her father, and was rudely shocked by a suspicion of his infidelity to her mother shortly before his death. She felt her mother had been gravely wronged and had to take her side, but at same time hated to see her mother who " had always been so suspicious of this kind of thing " morally exalted over her father. " She seemed to have been looking for this sort of thing all the time and now she has got it." The patient tried to disbelieve the allegations and to make every excuse for her father, but she never felt the same towards him again. "It seemed worse than if my husband had been unfaithful to me." She had very intense resentment against her mother, dating from earliest childhood memories, combined with fear of her and inability even now to hold her own with her in conversation. With this went a strong desire for her mother's affection, to which the latter did not respond: " Mother seemed cold to us as children—didn't seem to feel towards us as we did to her. I suppose she oughtn't to have had me." The patient had a strong resentment also against her only brother and his wife, whom the mother seemed to favour more than her daughters. She said that when talking about her brother she felt a tightness in her throat and stiffness in her neck. There was recent resentment at her mother's re-marriage: " It seems so unnecessary—we could have looked after her."

This was a small part of this patient's story. She was seen over a period of some months and showed very great resistance against discussing her attitudes to her parents, great fear of disloyalty in this matter, and also fear of allowing herself to realize the strength of her feelings, but eventually great relief and general relaxation of mental and physical tensions. She gained nearly a stone in weight and has now (1945) for over a year been working in a war factory.

CASE 3

An unmarried woman of 47 suffered for three months from lumbar and sciatic pains and recurrent pains in the neck, chiefly on the left side. Also during the last eight years she had a history of " tired heart ", fainting attacks, and " chronic laryngitis ". Two years ago she had an operation for " slipped kidney ", and has felt worse since the operation. She previously enjoyed good health, but had attacks of " muscular rheumatism " when aged 18 and 26.

She was the second of a family of four, and was intensely jealous of a brother three years younger; she recalled her violent tantrums when she saw him in her mother's arms. The usual treatment for these tempers was to have her head forced back by a spongeful of cold water applied to her face by her grandmother. She used to dread this punishment, and often had dreams in childhood—as well as waking sensations of suffocation—of having her head fixed back in a vice, and a clutching sensation in her throat. She remembered once, after one of her tantrums, being taken by her grandmother to see her mother lying apparently ill on her bed. On being told, " Look what you've done to your mother ", she was very remorseful and tried to kiss her but was refused. The " muscular rheumatism " at the age of 18 came during a time of

great resentment against her father, who was then drinking heavily and bringing poverty to the family. She was working against great odds to train as a teacher, and realized bitterly that she was the only one of her family to have been denied a secondary education. The second attack when 26, followed the death of her mother after she had nursed her during a very trying illness for two years, having had to give up her job to do so. She suffered much guilt over her imagined neglect of her mother, and a heavy sense of responsibility mixed with guilt over the administration of morphia tablets prescribed by the doctor. At times she felt the muscles of her neck " all matted up " and used to " savage " them with a kind of self-massage. After this a long and unhappy engagement was finally broken off, largely owing to the antagonism of the prospective mother-in-law. The patient then rather desperately threw her energies into various jobs and kept out of doctors' hands for thirteen years. The present symptoms came on while she was housekeeper to a widower, in whose house she was much imposed upon, and where she developed deep antagonism to his very unmanageable boy. Various dreams and associations linked this boy with her young brother, and revealed violent death-wishes. She had also fierce resentment and death-wishes against her mother in many dreams. She was surprised and very shocked as the degree of her aggression was gradually interpreted to her. One attack of pain and stiffness in her neck came during the course of treatment after she had been reading of some Fascist atrocities in Rumania, and she had felt compelled to brood over this for a few days. This also made her recall that when a girl she had had the same feelings and muscular pains after reading about the Spanish Inquisition.

Great improvement followed her realization and free discussion of her aggressive impulses; she appeared also to have much relief after relating many dreams of very aggressive and sexual content, and after a partial interpretation of some of these, she not only had a diminution of pains, but she volunteered that she no longer felt " a drawn, tense feeling in the face " and that she slept in a relaxed attitude whereas she used to sleep in a state of clenched flexion. She described a " loosening out ": " I feel I'm clearing a space around myself." When seen again after a period of four years, she declared herself better than she had felt for many years; she had gained weight, had a much happier facial expression, and had been working without interruption from sickness for four years.

Discussion

In the investigations and case histories just recorded the description of " muscular pains " was used, thus leaving open the question whether these represent " true rheumatism " in the sense of the definition quoted at the beginning of the paper, namely, a condition with a local tissue change.

If there is no local peripheral change the only likely explanation of these pains would be that of a central alteration of perception, or a lowering of the threshold to pain.* This mechanism would represent that of a pure conversion hysteria, comparable with the type of case with hysterical anaesthesia or hyperaesthesia. This type of case is, however, generally acknowledged now to be rare in such a series compared with the various types of anxiety states, many of which may have presenting somatic symptoms. The high incidence of these pains in the present series of 183 patients was altogether out of proportion to the incidence of the typical case of conversion hysteria. The common accompaniment of other

* The rather facile acceptance of the view that psychoneurotic individuals are hypersensitive to pain has been challenged by a recent experiment, in which psychoneurotic subjects of low-back pain were injected with a silver nitrate solution. The pain, limitation of movement, and tenderness following these injections lasted from five to six days, and showed no prolongation when carefully compared with the results of similar injections in normal controls. I am grateful to Dr. J. Paulett for permission to quote this observation from his paper, which is not yet published.

symptoms and signs, such as dyspepsia, headaches, and tachycardia, suggested also that in most of these patients the fundamental disorder was based on a state of anxiety with its physical accompaniments, and this was supported by the psychological investigations.

Although the type of pure hysteria is comparatively rare, however, the conversion mechanism may more often be found in conjunction with anxiety symptoms. Certain bodily changes may occur primarily as physiological accompaniments of emotion, but may also to some extent be substitute expressions of the emotion, which partially relieve and replace it. Thus a muscular tension which may be part of a pathological emotional reaction of infantile aggression may then form a substitute for its direct expression, as a rigid unyielding posture symbolizing an equivalent mental attitude. These symbolic expressions may still, however, be based on local tissue changes in the muscles themselves. It will be shown later that the predominance of symptoms on the left side may, in the same way, have a primarily physiological and secondarily symbolical explanation.

The Psychopathology

The case histories recorded were typical of many others in the series. In what way were these patients ill? All three were faced with hard circumstances in the form of difficult problems of personal relationships. The first had uncongenial work under a hostile employer and found difficulty in altering this without upsetting his home and mother. The second patient had a physically unsatisfactory marriage and a lonely frustrated social life. The third patient was approaching the menopause, disappointed in her prospects both of marriage and of an interesting career, and out of sympathy with the more favoured members of her family. In all three patients, however, the contemporary emotional problems were closely linked with earlier conflicts in the same field of personal relationships and extending right back to what might be regarded as the developmental stage of their capacity for these relationships, within their own families, in early childhood. Emotions of resentment rather than of fear seemed most prominent, but traced back to its earlier manifestations this resentment was strongly mixed with anxiety, in the way that anger and fear are often mixed together almost as one emotion in early childhood, as in certain animal behaviour. Like most of the other patients in this series, it was not easy to place them in a rigid psychopathological classification as patients with anxiety states, conversion hysterias, etc.; but at the basis there was a state of anxiety associated with deep emotional conflict which lay behind the contemporary mental problems of these patients.

The Question of Psychosomatic Relationship

"Psychosomatic" medicine is a study based on supplementing the usual clinical methods of examination by psychological methods such as those just described. It implies no dichotomy between mind and body: it is the method of

approach which is two-sided, not the object of the study. The following discussion of " psychosomatic relationship " is an attempt to correlate the findings which result from these two methods of approach.

Even those most sceptical of psychosomatic conceptions recognize that emotions are commonly accompanied by bodily changes of the kind demonstrated by Cannon's outstanding work (1939). Such bodily changes are easily seen to be biologically appropriate, mobilizing the full resources to deal with the circumstance which arouses the emotion, preparing, for example, for fight or flight in the face of danger. It is not surprising that skeletal muscles should be affected in this way. The very word emotion (movement from) suggests muscular preparedness. Muscular tension is " an expression of the personality's habitual defences " (Dunbar, 1938). Apart from voluntary tension and " bracing up ", there are certainly involuntary changes of muscle tension, the skeletal muscles being governed at both levels, cortical and thalamic (Cannon, 1939). Darwin (1872) described the variety of some of the muscular tensions in animals which he called " the language of the emotions ". In the human infant also expressive movement and gesture has been described as a " pre-verbal language " (Wolff, 1945). This language is, however, limited to convey only the current feeling-tone of the individual, or, as we might call it, " the mood of the moment ". In adult man the development of the verbal language faculty largely supersedes the " language of the emotions ". A sign or a series of sounds then serves as a substitute for an object or a concept and can thus be used as a means of transferring ideas rather than mere feeling-tone to a second individual. Speech then comes to form " a manifestation of partial motor inhibition " (Sherrington, 1933). In psycho-analytic terms this process corresponds with the development of the ego, which " by interposing the process of thinking secures a postponement of motor discharges and controls the avenues to motility " (Freud, 1923). Personal relationships based on this faculty constitute what Burrow (1941) has called a " socio-cortical segment of reactions ", as compared with the " phylo-thalamic segment " which governs the organism's primary adaptation to its environment.

Now psychoneurotic reactions have been defined as " abnormal mental states . . . which are the result of persistent mental conflict over personal relationships, past or present, in regard to others or to oneself " (Gillespie, 1942). This psychopathology of personal relationships nearly always extends back to their developmental period in the first few years of life (as was illustrated in the 3 case histories described). And during this period cortical activity is still immature and the child is dependent on emotional expression controlled by thalamic centres. The psychoneurotic adult, therefore, whose response to a situation of difficulty or danger largely reactivates earlier conflicts in the field of personal relationships, tends to react in this " phylo-thalamic " rather than " socio-cortical " fashion. As a part of this emotional response many bodily changes may occur which are quite inappropriate to the current circumstances. The emotion, including its associated bodily changes, is an anachronism. The result is something quite

different from what is commonly implied by the effects of worry, grief, or shock. It is an essentially pathological condition: a pathological emotional state including, among other bodily changes, a pathological muscular tension. There are four reasons why this tension should be pathological. The first is its anachronistic nature, already mentioned. Unusual muscle groupings may be employed, reproducing tensions and postures to which adult human adaptations have made the individual unaccustomed. Secondly, these tensions may be of more prolonged duration. The patient with psychoneurotic conflict is often faced by difficulties and dangers which are inescapable because they are internal rather than external. Far from allowing relaxation, sleep often leads to an increase of this tension; hence very often the symptoms are worse on waking. Thirdly these tensions are, owing to the characteristics of neurotic conflict, incapable of adequate discharge in action. Fourthly these tensions may sometimes be even more forceful than voluntary muscular contractions. It is well known that people who grind their teeth during sleep cannot voluntarily reproduce such violent contraction, and Saul (1941) suggested that contraction of the trunk muscles during sleep may be as strong as this.

It seems reasonable, then, to suggest that these pathological tensions may be as aetiologically relevant as chill, fatigue, infection, and the other suspected causative factors of non-articular rheumatism which have been described; and as more than one of these factors, internal and external, may contribute to a given case of rheumatism, so the emotional factor may be combined with others or may be the sole or predominant cause. Corresponding with the degrees of severity and the length of duration of mental conflicts there may be a wide range in the severity of the rheumatism, from transient and vaguely defined pains to chronic and more localized regions of pain, stiffness, and tenderness. But the same range may also be found in rheumatism provoked by other factors such as chill or infection. The muscular pains following chill or unaccustomed exercise may be vague or transient but none the less " rheumatic " in the sense that they are based on local tissue changes, even if no fibrous nodules can be demonstrated. It was shown also that even those writers who describe the pathology of fibrositis with most precision suggest that there are stages in this process (such as abnormal spasm, increased exudation, or altered local metabolism) short of the fully developed condition.

Greater Incidence on the Left Side

This question is of interest both for its own sake and also for its bearing on the general mechanism of psychosomatic rheumatism. I have already shown that 51 out of 87 patients complained of pain more on one side than the other, and that 44 had left-sided pains and 7 right. Halliday (1937) in a series of 21 patients with neck and shoulder pains found 13 left-sided compared with 1 right. In a later paper, also, he described a characteristic left shoulder pain which he called " the neuritis of deprivation " owing to the frequency with which it is found to

follow misfortune or " sinister events " (Halliday, 1941). Halliday explained this in terms of symbolism. The symbolic association of the left side in folk-lore and myth, superstition and dreams, with disaster, grief, and various forms of evil, is well known, and it is acknowledged by the use of the word " sinister " as opposed to " righteous ". But while accepting the fact of this symbolic association, it might be possible to explain rather more precisely why and how these symptoms develop on the left side and incidentally also to bring some light on the question of how this symbolic association has arisen.

First it may be recalled that 2 patients in my series whose pains were chiefly right-sided were left-handed individuals. In Halliday's series the one patient with right-sided pains was described in the case history as being ambidextrous, though no comment was made on this. Now, since so-called ambidextrous individuals are usually left-handed people who have been trained to become right-handed, Halliday's observation supports my own figures in suggesting that the factor of importance in unilateral psychosomatic rheumatism is not the left side as such but the non-dominant side. It seems very probable that habitual muscular tensions differ between the dominant and non-dominant sides of the body. This may well be associated with facial asymmetry, which has been illustrated by Wolfe (1933) who, by making reconstructed portraits of double left-sided and double right-sided faces, showed that the right face expressed the individuality, changing from year to year, while the left side was more instinctual and changeless, and representative more of the species than of the individual. It has been noted also that facial asymmetry is more pronounced in very strongly left- or right-handed individuals (Ogden, 1929). Wolff (1945) showed that the gestures of the right hand express individual, voluntary impulses while those of the left hand betray the unconscious instinctive reactions. Now this dominant laterality is, of course, dependent on the same unilateral cerebral dominance which " forms the hall-mark of the language faculty " (Orton, 1937). Russell Brain (1945) states that " we can be reasonably sure that the dominance of one hemisphere was a pre-condition of symbolic thinking and expression which at the psycho-physiological level distinguishes man from all other animals, and we may guess that when human culture first developed man was already both able to speak and predominantly right-handed ".

It has been already shown that it is the development of language which, superseding the merely thalamic expression of emotion (including postural tensions), enables the normal human adult to exert a cortical restraint on his thalamic reactions, and thus to deal more adequately with adult situations of difficulty or danger. In the same way, and at about the same time in the child's development, a dominant laterality, expressive of the individual and under cortical control is superimposed on and largely supersedes a symmetrical muscular tension-pattern under purely thalamic control, which belongs to the infantile, animal, " phylo-thalamic " level of reaction.

When, as in certain psychoneurotic reactions, these early tension-patterns are

revived, the non-dominant side of the body may be most affected, because it is less influenced by the cortical impulses which habitually modify the thalamic reactions on the dominant side.

This, then, is suggested as a possible explanation of the greater incidence of psychosomatic rheumatism on the non-dominant side of the body. It might also explain the origin of the symbolism which links the left side with the more primitive instinctual level of the mind and with the idea of evil which is evoked by man's deep-seated fear of his crude instincts and of their symbolic representations, such as Pan and Satan, which signify not only the " temptations " afforded by these instincts but also the dangers which they may provoke in the way of punishment.

Summary and Conclusions

Muscular pain was a prominent symptom in 87 of a series of 183 patients with psychoneurosis (47%).

In 51 of the 87 patients the pain was mainly unilateral (44 left-sided and 7 right). At least 2 of the 7 patients with right-sided pains were left-handed.

Three case histories were described to illustrate that these patients suffered from persistent conflicts over personal relationships. These conflicts extended back to the developmental stage of the capacity for these relationships, before the acquisition of symbolic speech, and at a period when emotional expression, under purely thalamic control, includes changes in muscular tension.

Muscular tensions thus later reproduced may be pathological because they are anachronistic, abnormally prolonged, and incapable of discharge in action.

It is considered that these pathological tensions may rank with other factors such as chill, infection, or physical strain in promoting local tissue changes. They may act alone or in combination with these other factors.

It is suggested that the common left-sided incidence of these pains may be due to a relative freedom of the non-dominant side of the body from the cortical control which modifies the thalamic reactions on the dominant side. This control develops in close association with the speech faculty which largely supersedes the more primitive response to danger.

This study concludes that the muscular pains of patients with psychoneurosis are on the balance of probability due to peripheral changes rather than to central alterations of perception. They may, therefore, be justifiably described as " rheumatism " and, more specifically, as psychosomatic non-articular rheumatism.

I am grateful to many who have read and criticized the drafts of this paper, and especially to Dr. J. L. Halliday.

References

Annotation (1946). *Brit. med. J.*, **1**, 134.
Baker, D. M. (1942). " Cardiac Symptoms in the Neuroses." London.
Boland, E. W., and Corr, W. P. (1943). *J. Amer. med. Ass.*, **123**, 805.
Brain, W. Russell (1945). *Lancet*, **2**, 837.
Burrow, T. (1941). *Psychosomat. Med.*, **3**, 174.

Cannon, W. B. (1939). " Bodily Changes in Pain, Hunger, Fear, and Rage," 2nd ed. New York.
Copeman, W. S. C. (1939). " The Treatment of Rheumatism in General Practice," 3rd ed. London.
—— (1943). *Brit. med. J.*, **2**, 263.
—— and Ackerman, W. L. (1944). *Quart. J. Med.*, **13**, 37.
Cyriax, J. (1938). *Brit. med. J.*, **2**, 1,367.
Darwin, Charles (1872). " The Expression of the Emotions in Man and Animals." London.
Dunbar, H. F. (1938). " Emotions and Bodily Changes." New York.
Elliott, F. A. (1944). *Lancet*, **1**, 47.
Ellman, P., Savage, O. A., Wittkower, E., and Rodger, T. F. (1942). *Annals of the Rheumatic Diseases*, **3**, 56.
Fetterman, J. L. (1940). *Psychosomat. Med.*, **2**, 265.
Flind, J., and Barber, H. S. (1945). *Quart. J. Med.*, **14**, 57.
Freud, Sigmund (1927). " The Ego and the Id." Translated. London.
Gillespie, R. D. (1942). " Psychological Effects of War on Citizen and Soldier." New York.
Gordon, R. G. (1939). *Brit. med. J.*, **1**, 1,165.
Halliday, J. L. (1935). *Ibid.*, **1**, Suppl. 85.
—— (1937). *Ibid.*, **1**, 213 ; 264.
—— (1938). *Ibid.*, **2**, 11.
—— (1941). *Ann. intern. Med.*, **15**, 666.
—— (1942). *Brit. med. J.*, **1**, 164.
—— (1943). *Lancet*, **2**, 692.
—— (1944). *Practitioner*, **152**, 6.
Heaton, T. G. (1944). *Canad. med. Ass. J.*, **50**, 515.
Horder, Lord (1941). " Rheumatism. A Plan for National Action." London.
Hurst, A. (1943). *Brit. med. J.*, **11**, 773.
Hutchison, J. H. (1942). *Glasg. med. J.*, **137**, 33.
Jackson, W. P. U. (1943). *Brit. med. J.*, **11**, 776.
Kellgren, J. H. (1938). *Ibid.*, **1**, 325.
Kelly, M. (1945). *Annals of the Rheumatic Diseases*, **5**, 1.
—— (1945–46). *Ibid.*, **5**, 69.
Lewis, T. (1938). *Brit med. J.*, **1**, 321.
Ogden, C. K. (1929). " The A.B.C. of Psychology," p. 249. London.
Orton, S. T. (1937). " Reading, Writing, and Speech Problems in Children." London.
Saul, L. J. (1941). *Psychosomat. Med.*, **111**, 190.
Sherrington, C. (1933). " The Brain and its Mechanism." (Rede Lecture.) Cambridge.
Wolfe, W. (1933). *Character and Personality*, **11**, 168.
Wolff, C. (1945). " A Psychology of Gesture." London.
Wood, P. (1941). *Brit. med. J.*, **1**, 767; 805, 845.

THE HEBERDEN SOCIETY

A meeting of the Society was held at the Royal Free Hospital, Gray's Inn Road, London, on Feb. 14, 1947, with Mr. S. L. Higgs, President, in the Chair.

Discussion on Brachial Neuralgia

DR. ERNEST FLETCHER, opening the discussion, began by considering the causes of this syndrome on a regional anatomical basis. Finally, he came to the causes of brachial neuralgia which operate around the ribs and clavicle, and devoted the remainder of his address to this aspect of the problem. The principal causes in this area are: (1) cervical rib; (2) abnormalities of the first thoracic rib; (3) abnormal thoracic outlet; (4) costo-clavicular compression; (5) scalenus anterior syndrome; (6) aneurysm of subclavian artery (resulting from one of the above and producing pressure symptoms); (7) compression over a normal first thoracic rib.

After giving a brief sketch of the anatomy of the structures which pass between the clavicle and the first rib, he pointed out that the subclavian vein was the most medial structure and came within the "jaws of the vice" represented by the rib and clavicle. It was thus likely that any constriction in this neighbourhood would affect the vein first. In addition to this, the scalenus anterior muscle to some extent protected the artery and the roots of the eighth cervical and first dorsal nerves, so that it seemed as if the operation of scalenotomy might in some cases remove the protection to these structures and make the patient's symptoms worse. Le Vay (1945)[1] had reported such a case. In spite of this, however, the operation was sometimes successful.

The old concepts of cervical rib and scalenus anterior syndrome had been modified as the importance of constriction at the thoracic inlet and between the pectoralis minor and the coracoid process became increasingly recognized. This concept of costo-clavicular compression was first suggested in 1939 by Eden,[1] and was brought forward to explain the finding of an aneurysm of the subclavian artery distal to a cervical rib. Falconer and Weddell (1943) [2] and Wright (1945) [3] had stressed the fact that various positions of the shoulders might lead to pressure on the subclavian artery and obliteration of the radial pulse. The significance of these observations had yet to be assessed. It was evident that it was important to identify the structure involved at an early stage in any new case. To this end various methods were in use. The angle of the clavicle with the horizontal gave some indication of the height of the shoulder girdle relative to the thorax. A radiograph of the thoracic inlet gave the ratio between the midline and the outer edge of the first rib in relation to the midline and the acromio-clavicular process. This naturally should be equal on the two sides, and, in common with such things as scoliosis, gave an indication of asymmetry of the inlet. Walshe and others (1944) [4] stressed this, and concluded that asymmetry was a factor in the production of many of the symptoms.

In considering the symptoms themselves, it was necessary to determine whether venous obstruction was a substantial factor. Dr. Fletcher, working with Dr. C. F. Hawkins, had done some estimations of venous pressure in normal subjects and had compared the results obtained with those found in cases of first rib thoracoplasty, where costo-clavicular compression could not be a factor. Twenty-six estimations of venous pressure showed an average rise of 6·7 cm. when the shoulders were braced backwards, whereas the average in 8 cases of thoracoplasty was only 2·3 cm. A fall of venous pressure occurred in 3 of these latter cases, but in none of the others. In 7 of the 26 cases the pulse was obliterated by bracing back the shoulders, but the

[1] Le Vay, A. David (1945). *Lancet*, 2, 164.

[1] Eden, K. C. (1939). *Brit. J. Surg.*, 27, 3.
[2] Falconer, M. A., and Weddell, G. (1943). *Lancet*, 2, 539.
[3] Wright, I. S. (1945). *Amer. Heart J.*, 29, 1.
[4] Walshe, F. M. R., Jackson, H., and Wyburn-Mason, R. (1944). *Brain*, 67, 141.

venous pressure showed more than the usual rise. No relationship could be demonstrated between the rib-clavicle ratio and the rise in venous pressure. Sampson and others (1940)[1] wrote an excellent paper on this aspect, and showed the importance of the superficial collateral circulation which does not pass through the subclavian vein. This was an important factor, as it might lead to false conclusions from the estimations of venous pressure.

The arterial manifestations included such symptoms as cyanosis, marked pallor, and sometimes Raynaud-like attacks in the arms and fingers. The ischaemia and pain in the limb, sometimes accompanied by embolism arising from the occluded subclavian, were inconstant features. A trap for the unwary existed in the fact that an aneurysm, either patent or occluded, might cause symptoms of a neurological character from pressure on the nerve trunk. Nervous manifestations included sensory symptoms, pain, and paraesthesiae referred to the hand and fingers. It was somewhat doubtful whether the classical description of motor symptoms, including wasting of the outer half of the thenar eminence, were as constant as was usually described. The patient was usually a woman in the older age groups, and precipitating factors, such as a history of carrying heavy weights or a baby, were common. The drooping of the shoulders after childbirth might be responsible. Paralysing the scalenus anterior was of use as a clinical test, to see whether this muscle were playing any part in the production of symptoms. Unfortunately, the results were somewhat anomalous, but in at least 2 cases where it had previously been obliterated this procedure had been followed by the reappearance of the radial pulse on bracing back the shoulders.

Lastly, the syndrome of acroparaesthesia, or compression over a normal first rib, was discussed; and it seemed clear that many cases fell into this group, which was due to a sagging of the shoulder girdle. The cases usually complained of bilateral pain or numbness, and as a rule there were no physical signs and the symptoms came on at night. Purdon Martin has described similar syndromes in the legs.

It now seemed clear that brachial neuritis was uncommon, but occurred in two fairly well defined forms, one of greater frequency than the other. A true neuritis might be associated with focal sepsis; more commonly it occurred in epidemics such as had been described by several authors, notably Wyburn-Mason (1941),[1] Spillane (1943),[2] and Turner (1944).[3] They had all been recorded during the 1939–45 war, and as the clinical picture had varied it would be interesting to see whether these epidemics continued in peace-time.

* * *

DR. PURDON MARTIN said that looking through a manual of neurology by Gowers published fifty years ago he found all sorts of "irritative" conditions which gave rise to tenderness and pain down the arm attributed to interstitial brachial neuritis. During the last half century this group of brachial neuritis had been so broken up into all the conditions that Dr. Fletcher had enumerated in his comprehensive survey that they were now exercised in their minds as to whether interstitial neuritis even existed. Gowers had referred to one particular group of cases which he called radicular neuritis, by which he meant that the signs were referable to a single spinal root; and those were cases which had been interesting neurologists and others during the last few years because it had been discovered that many of them were due to lesions of an intravertebral disc. Such lesions were not at all infrequent in the cervical region, and they gave rise to signs and symptoms which were due partly to nervous involvement and partly to vertebral disturbance. The nervous signs and symptoms were nearly always those resulting from pressure on a single nerve root, and in the cervical region there was a very strong tendency for such lesions to be about the fifth and sixth cervical vertebrae. When the disc affected was the one below the sixth vertebral body it gave rise to compression of the seventh cervical root, and that was the commonest, the one above being not very common, and the others—the high ones—decidedly uncommon.

[1] Sampson, J. J., Sanders, J. B., and Capp, C. S. (1940). *Amer. Heart J.*, **19**, 292.

[1] Wyburn-Mason, R. (1941). *Lancet*, **2**, 662.
[2] Spillane, J. D. (1943). *Ibid.*, **2**, 532.
[3] Turner, J. A. (1944). *Brit. med. J.*, **2**, 592.

In most cases the protruding portion of the disc came out laterally and interfered with the nerve root at the intervertebral foramen. The signs were at first irritative, and later there were some signs of impairment of function. An important point concerning the irritative phenomena was that the distribution of each root overlapped that of its neighbours, and although there was only a strip down the middle of the hand (including the middle finger) as the primary or principal distribution of the seventh cervical nerve, nevertheless fibres from this nerve overlapped the distribution of the sixth and eighth cervical nerves, not completely but in certain areas, and particularly in the lower part of the sixth cervical area, including the index finger. Secondly, although ordinarily it could not be recognized until it came down to the hand or lower part of the arm, there was a representation of the seventh cervical nerve the whole way from the vertebral column downwards, and if the nerve root was irritated then pain occurred throughout the whole of that distribution, and consequently might be experienced right down the arm and in the second and part of the first finger, and possibly more widely than that. With irritation of the seventh cervical root by a protruding disc there might then be pain which came from the vertebral column down over the back of the shoulder and along the outside of the arm into the forearm, probably both at the back and front. It might not all be pain; sometimes it was merely paraesthesia, and this was usually felt in the second, and to a less extent in the first, finger.

Very soon some signs of interference of function of that root might be experienced, giving rise to motor, reflex, and sensory disturbances. The motor disturbances were usually not very pronounced, but if they went on for a long time then a certain amount of wasting resulted. (Dr. Martin showed some radiographs of a patient who had had sensory disturbance for three years and had wasting in the forearm and in the triceps.) Far earlier than this there was a reflex disturbance, namely, the abolition of the triceps reflex, and then some loss of sensation might be discovered in the area supplied by the seventh cervical nerve, namely, in the middle finger and to a less extent in the index finger. Very often a patient would complain only of the index finger, which he used most. The important point was that the signs found were all referable to the distribution of a single root.

If the patient had all these disturbances referable to one root—in this case the seventh cervical—he might complain as well of some stiffness in the neck and would probably say that when he bent his head toward the affected side the pain was aggravated. A radiograph of his neck might not show anything abnormal, but if the condition had persisted for some time there would probably be diminished joint space, with lipping of the borders of the adjacent vertebrae, a rigid appearance of the cervical spine, and possibly slight angulation at the site of the lesion. In certain cases fuller evidence could be obtained by injecting an opaque medium into the theca. Each root as it left the theca had a little funnel-shaped sheath of meninges, and these sheaths in turn could be filled with the contrast medium until the one root which was compressed was reached, when none of the opaque medium would go into the funnel. Very often that was the only abnormality it was possible to demonstrate with the opaque medium. The only satisfactory opaque medium for this purpose that he had found was pantopaque, of which there was a certain supply when the American troops were over here, but which was now unobtainable. Lipiodol in his experience was completely useless, and in fact misleading. The only case of his own which had been operated upon was one in which they were able to obtain pantopaque and demonstrate both an indentation of the theca and failure to fill the root sheath. Unless pantopaque could be obtained he did not think they should expect to demonstrate this alteration.

The vertebral signs, then, were stiffness of the neck, possibly some angulation at the site of the lesion, and possibly some narrowing at the intervertebral space. In the case of his own which he had just alluded to there was also compression of the side of the spinal cord, so that the patient, besides having a neuralgic pain down the left arm, exhibited the Brown-Séquard syndrome below that level. This patient was operated on by Mr. Northfield, who was able to push the theca gently to the side and expose a protruding " knuckle " pushing forward the intervertebral ligament, and as soon as he incised the ligament a fillet of cartilaginous material quickly wormed its way out. It was under considerable tension. The seventh nerve root was stretched over that protruding knuckle. It was probably not only the stretching, but also movement, which caused the pain in these cases.

There had not been call to operate on many cases. He had asked several of his neuro-

surgical colleagues their experiences, and some had done no operation on these cervical cases. Most had done some in the dorsal region, and many in the lumbar region, but they were all chary of interfering with the cervical or dorsal region because they must approach from behind, and these protrusions were in front of the cord, so that there was a great risk of damage to the cord in the process of either getting round the theca or going through the theca and pushing the cord aside. Therefore the surgeons were not anxious to operate on these cases, and generally would do so only if the spinal cord was compressed. The cases in which a root was compressed got better in large numbers in the course of a few weeks or months; few of them lasted for years. On the whole, the outlook was better in the cervical cases than in the lumbar, but he did not know why. He did not suppose that the protrusion went back, because protrusions were found when the history indicated that they had probably been present for years; but the nerve root, he thought, adapted itself, and that was why in brachial neuritis or in sciatica a considerable time was usually required.

It was also important to get the patient in a comfortable position. The more he was free from pain the more quickly he got better. Almost anything done to relieve pain was a help towards cure. There was cause to operate on few of these cases, and in general they made good recoveries. The patient to whom he had twice referred, who had had some symptoms for three years, was virtually free from pain. He had other symptoms which were referable to severe pressure on one nerve root, including a certain amount of lack of postural appreciation, so that he found it difficult to hold a pen, and it was for that reason he came under observation, and not so much because of pain. Therefore, even in cases where a great deal of pressure persisted, the pain usually passed off after a few months.

A few words about other syndromes. If the lesion were higher, then the signs might be a little different. If a disc compressed the sixth root it might abolish the biceps jerk or weaken it, and cause pain on the upper border of the forearm, and pain in the thumb or paraesthesia of the thumb or first finger. In other words, the symptoms were all a little higher up. The vertebral signs, of course, were the same. It sometimes happened that the fifth root was affected. The fifth root was a root which was very largely motor, and if at all badly affected was more liable to cause paralysis than any of the other roots: paralysis of the deltoid was the outstanding sign.

Other things might give rise to similar signs. One patient complained of pain in her left arm, some sensory loss, and wasting in the extensors of the forearm and also in the small muscles of the hand. She had lost the triceps jerk. A radiograph showed that she had some erosion on the side of the cervical vertebrae; she proved to have a large neurofibroma on one of the nerve roots, which actually came out beyond the vertebral column and caused some compression of other roots outside the vertebral canal. Much of the mass was removed, and she was to a great extent relieved. Such neurofibromata might give rise to very similar symptoms, but usually to a more definite sensory loss than a disc compression, and, later on, to more extensive disturbances. As time went on, the disc disturbance would remain limited to a single root, whereas the neurofibroma as it expanded would affect other roots, or it might affect the cord. Furthermore, neurofibromata gave rise to a very high protein content of the cerebrospinal fluid, while the disc lesion caused practically no alteration. A simple radiograph would probably show some disturbance, and an oblique view, taken to show the vertebral foramina, would probably show a considerable enlargement of one foramen, whereas the disc lesion did not. Some obstruction would probably be found in the theca.

Dr. Fletcher had referred to what the speaker called paralytic brachial neuritis. Since about 1939 they had, he thought, to acknowledge two forms of brachial neuritis—the old-fashioned " interstitial " form, and the new-fashioned paralytic brachial neuritis which they began to see just before the outbreak of the war in 1939, and which continued through most of the war years. These cases were often associated with severe pain, but the unusual thing about them was the paralysis. They affected all parts of the plexus, and caused paralysis of any of the muscles supplied by the nerves of the brachial plexus.

The only cause of pain Dr. Martin could mention which was not on Dr. Fletcher's list was thalamic pain—a condition which occurred in association with lesions affecting the thalamus. It was usually associated with hemiplegia, and it was characterized by considerable over-reaction to painful stimuli and possibly spontaneous pain. That was sometimes regarded as brachial neuritis or brachial

neuralgia, and he had known several cases in which the patient had received treatment to the arm itself, whereas the arm was affected only as part of the cerebral syndrome.

In reply to Dr. Hoffman, Dr. Purdon Martin said that the younger the patient the more likely was the lesion, low or high, to be a disc lesion, but in older patients arthritic conditions came much more into the picture. He believed that osteo-arthritis made the disc more brittle and caused greater liability to adhesions.

The PRESIDENT said that in his hospital the experience of disc injuries and their treatment corresponded with that of Dr. Purdon Martin. The orthopaedic department and the neuro-surgical department worked closely together and the neuro-surgeons carried out the operations on the discs—on lumbar discs about three or four hundred to three or four (that sort of figure) on cervical discs. He had been impressed by the case of a man who came to the out-patient department with intense pain in both arms, deformity of the neck, and spastic muscles. He was admitted to hospital and the diagnosis of cervical disc lesion, with all the neurological signs, was made. The man could not be made comfortable, and, therefore, under pentothal he had gently stretched the neck and put him in plaster, and within two days he was free from pain. Only that same morning he had seen him walking about in the ward quite without pain, and the neurological signs were quickly receding. A little numbness over the thumbs was all that appeared to be left. Apart from rest in bed, it did appear that plaster was a good thing.

Dr. K. N. LLOYD said that, in such cases as Dr. Purdon Martin had described, of osteo-arthritis with definite localizing signs, the majority had a narrow disc space in addition to the osteo-arthritis. It was a question which came first. Was it an old disc with secondary osteo-arthritis on the top of it, or was it an osteo-arthritis which had degenerated and had made the disc more liable to rupture? He had the impression that the second of these possibilities was the more likely. It was difficult to find a history of previous trauma and previous brachial neuralgia to account for an early prolapsed disc, and, secondly, most patients had had their symptoms for weeks or months, and often the symptoms came on suddenly. Radiographs showed that the osteo-arthritic changes were too marked to have come in a matter of weeks or months.

Mr. TIPPETT had been impressed in some cases of lesions of a lumbar disc with sciatica by the dramatic relief after simple manipulation. Many cases of brachial neuralgia which might be put down to prolapsed disc lent themselves to ordinary physiotherapy methods.

Dr. L. C. HILL said it was his impression, on seeing some of these cases of neuritis in the arm to which Dr. Fletcher had referred, that those in which the sixth and seventh cervical roots were affected nearly always recovered, either quickly or slowly, whereas those in which the fifth cervical root was affected never, or virtually never, recovered. He wondered whether that was a correct observation, and, if so, whether there was any reason for it.

ROYAL SOCIETY OF MEDICINE

SECTIONS OF MEDICINE AND PHYSICAL MEDICINE

A joint discussion between the sections of Medicine and Physical Medicine of the Royal Society of Medicine, on the aetiology of rheumatism, was held on Jan. 28 in London. This was opened by Dr. W. S. C. Copeman, who reviewed the history and development of the various theories that had been held with regard to aetiology. Dr. Philip Ellman then gave a symposium of the known facts bearing on the causation of rheumatic disease and allied arthropathies, together with photographs and radiographs of cases and some graphs showing the incidence of factors such as age, occupation, worry, shock, poverty, etc., on different rheumatic types. He favoured the unitarian theory of the causation of rheumatism.

Dr. G. D. Kersley followed this summary with a reasoned argument for a sensitization factor as the connecting link between the various syndromes—first excluding osteo-arthritis as being a disease of joints occasioned by a predisposition to early senility coupled with trauma or repeated microtraumata. The remaining syndromes were all generalized conditions of the mesodermal tissues, and he reviewed the evidence for the hypothesis that they were due to " an altered reaction of the macro-organism to invasion by a foreign protein ", and connected all the known aetiological factors either with depression of immune body formation (circulating antibody) or production of allergens. Graphs were shown indicating how the relative proportions of cell-fixed and circulating antibody could account for either the acute or chronic rheumatic states.

ABSTRACTS

[The abstracts are divided into the following sections: acute rheumatism; articular rheumatism (rheumatoid arthritis, osteo-arthritis, spondylitis, miscellaneous); gout; non-articular rheumatism; general articles. After each subsection of abstracts follows a list of articles that have been noted but not abstracted. Not all sections may be represented in any one issue.]

Acute Rheumatism

Immunologic Studies in Rheumatic Fever. II. Anti-streptolysin Patterns in Rheumatic Children. TARAN, L. M., JABLON, J. M., and WEYR, H. N. (1946). *J. Immunol.*, **53**, 381.

Much of the evidence for the aetiological relationship between rheumatic fever and streptococcal infection is based upon the contention that certain immunity responses of the rheumatic patient simulate those often observed in the course of streptococcal infections. The analogy between these responses does not, however, rest on a firm basis. Many types of immune bodies can be demonstrated in the serum of patients who have recently suffered from a haemolytic streptococcal infection, but the humoral antibody response to the exogenous streptococcal antigens seems at present to excite most interest, and this paper deals only with a study of the antibody response of the rheumatic patient to the streptolysin O. In view of the divergence of opinion in the literature about the nature of the relationship, if any, between streptococcal infection and the anti-streptolysin patterns, the authors present data on the anti-streptolysin pattern found in 460 children having active or quiescent rheumatic disease, rheumatic recurrences with or without preceding streptococcal infections, and streptococcal infection during the course of the quiescent phase of the disease.

An examination of the anti-streptolysin curves leads to a classification of 3 categories of pattern, which are fully described. The authors consider that the view that acute rheumatic fever cannot be considered a direct manifestation of the antigenic activity of the haemolytic streptococcus is corroborated in their study, since the presence of a high anti-streptolysin titre in a rheumatic patient did not denote activity of the process, nor did low anti-streptolysin values signify quiescence. Their observations showed that the anti-streptolysin curves seen in rheumatic children are one of the expressions of the immunological history of the individual—the antigen-antibody reaction of a person living in a streptococcal world. This antigen-antibody reaction may or may not be disturbed during the course of acute rheumatic disease. The advent of a streptococcal infection in a rheumatic patient may accentuate this antigen-antibody reaction, modifying the course of the usual anti-streptolysin pattern which results from a streptococcal infection alone. *W. S. C. Copeman.*

The Social Pathology of Rheumatic Fever. RYLE, J. A. (1946). *J. roy. san. Inst.*, **66**, 277.

The author emphasizes the need for further and intensive inquiry into the social pathology of rheumatic fever, and points out that "compulsory notification . . . would greatly assist those epidemiological and aetiological studies upon which further development of preventive action must be based". The problem of rheumatic fever is a large one. It has been estimated (Parkinson, *Lancet*, 1945, **2**, 657) that in Great Britain there are at least 200,000 cases of heart disease, mostly rheumatic, in persons between the ages of 18 and 41. The annual death rate from this condition is 16,000, and the incidence of rheumatic heart disease in school children has been variously calculated between 1 and 5%. The incidence in London fell from 2 to 0·77% between 1926 and 1937. A further drop may be expected to result from the improved housing scheme envisaged by the government.

Rheumatic fever may be regarded as "a specific type of response occurring at a susceptible age in the case of individuals having an inborn or acquired sensitivity to a common agent—an agent which, in most persons, provokes a local reaction only, or produces other types of general response". There is accumulating evidence that *Streptococcus pyogenes* is the infective agent. Sore throats commonly precede the attack, epidemics of streptococcal sore throat have frequently been accompanied by epidemics of rheumatic fever, and sulphonamides have been shown to have a valuable prophylactic effect in preventing recurrences. Rheumatic heart disease has "a strong correlation with poverty or, rather, with a complex of adverse circumstances which accompany poverty". Of these circumstances overcrowding is probably the most important, since outbreaks of streptococcal sore throat and rheumatic fever occur in boarding schools, barracks,

and training ships where nutrition is satisfactory and opportunities for open-air exercise plentiful. Further study is required on the relative importance of defective ventilation, defective light, dust, and other factors connected with poverty such as damp, bad housing, and poor nutrition. There are certain difficulties in connexion with notification. First, the diagnosis of rheumatic fever may be difficult. Then there are the questions of whether second attacks should be reported and whether a rheumatic lesion discovered for the first time in a child or adolescent in the absence of reactivation should be notified. It is suggested that all cases of juvenile rheumatism and chorea, of acute carditis and valvular disease should be notified locally and centrally; that all secondary attacks should be notified locally to ensure full use of consultant and social services; and that old-established rheumatic heart disease not recently reactivated and seen for late cardiac symptoms should not be notified. *H. A. Burt.*

The Prothrombinopenic Effect of Massive Salicylate Therapy in Acute Rheumatic Fever. OWEN, G. C., and BRADFORD, H. A. (1946). *Ann. intern. Med.*, **25**, 97.

Twenty-five cases of acute rheumatic fever were treated with 10 g. of sodium salicylate in 1,000 c.cm. of normal saline intravenously over a 4-hour period daily for 6 days or longer, depending on the patient's clinical course. Thereafter 10 g. of the drug was given orally each day in divided doses. Duration of treatment varied from 21 to 60 days. The prothrombin time was estimated by the Magath modification of the Quick method, and quantitative blood salicylate analyses were made at 3-day intervals throughout treatment. A moderate reduction of prothrombin to 55–75% of normal occurred in all cases after the third or fourth day of treatment. In addition a maximum effect of short duration was observed to occur in a number of cases. Two cases fell below 20% prothrombin, and 12 below 30%. Five with prothrombin percentages varying from 16 to 28% of normal developed epistaxis (only 1 severe) with splinter haemorrhages under the finger-nails. In all instances the salicylate therapy was continued, and the prothrombin percentages returned to normal and the bleeding ceased. This spontaneous tendency for the prothrombin levels to return to normal during the course of therapy suggests that hypoprothrombinaemia as a cause of serious haemorrhage in salicylate treatment is an unlikely occurrence. However, should operation be contemplated in such patients, the risk of haemorrhage warrants the use of vitamin K. The precise mechanism by which salicylic acid affects the prothrombin level remains to be determined. *D. M. Dunlop.*

Interference Dissociation—an Early Finding in Acute Rheumatic Fever. BARTLETT, A. G. (1946). *Amer. J. med. Sci.*, **211**, 686.

Of 32 cases of acute rheumatic fever seen during the past 2 years, 4 are reported which had electrocardiographic findings of interference dissociation as an early though transitory event. The disturbance in no case lasted longer than 5 days. In one it disappeared after exercise and after administration of atropine, thus demonstrating the part played by the vagus in its production. There have been few previous reports of the condition in rheumatic fever: in one the occurrence is recorded in 14 of 200 cases; in another in 6 of 100 cases. The author believes that the disturbance must at times be a manifestation of a morbid state of the heart muscle.

Kenneth Stone.

Seven Years' Experience in the Convalescent Care of Rheumatic Fever. HUBBARD, J. P., SIERACKI, L. A. and JORDON, I. (1946). *R. I. med. J.*, **29**, 655.

In 1938 the Sharon Sanatorium was turned over to the care of convalescent rheumatic children so as to help the problem of the disposal of such children when they left the general hospital. The need was for education to accompany semi-institutional care and protection from respiratory infection. At that time the fashion was to send such children to the warm southern States, where there is little rheumatic fever amongst the native population. The present experiment reversed conditions, as the routine was to place them under sanatorium conditions out of doors in the rigorous atmosphere of New England in an attempt to build up their resistance. In addition to open-air accommodation, the customary methods of symptomatic treatment were used, together with rest in bed until all signs of activity had disappeared, after which activities were progressively increased under strict control. School teachers were employed for educational, social, and recreational rehabilitation, and medically trained social workers experienced in the problems of rheumatic fever provided a social survey of the patients' homes, made contact with the parents, and maintained contact after discharge. Dental treatment was also given. Patients remained in the sanatorium from two to eight months, and after discharge had periodic medical examination at the Massachusetts General Hospital.

The authors do not analyse their figures in comparison with other groups, but state that the "incidence of recurrence and the mortality compare very favourably with results for any comparable group". [The authors call this the first attempt to employ such a method of

care for the rheumatic child; they are evidently unaware of the pioneer work of the Cheyne Hospital in England before the war.]

W. S. C. Copeman.

Acute Abdominal Syndrome in Rheumatic Fever. (Cuadros agudos de vientre en la fiebre reumatica.) PIAGGIO BLANCO, R. A., DUBOURDIEU, J., and CASAMAYOU, E. (1946). *Arch. urug. Med.*, **28**, 543.

Attention is drawn to the comparative frequency of acute abdominal pain in rheumatic fever and to possible mistakes in differential diagnosis. It is suggested that this diagnosis should be considered whenever an abdomen is opened and found to contain sterile serofibrinous fluid in the peritoneum, without other appreciable macroscopic lesions, the diagnosis being suggested clinically only by slightly unusual acute abdominal signs, with a history indicating the rheumatic state. Surgical intervention should be postponed only when vigilant medical attention is available in hospital. Salicylate therapy is said to cause disappearance of symptoms within a few hours where rheumatic fever is the cause of the condition. *G. D. Kersley.*

Rheumatic Fever in Naval Enlisted Personnel. II. Effectiveness of Intensive Salicylate Therapy in Cases of Acute Infection. MANCHESTER, R. C. (1946). *Arch. intern. Med.*, **78**, 170.

By "intensive" salicylate therapy in acute rheumatic fever this author means (1) a slow intravenous injection lasting 6 hours of 10 g. of sodium salicylate in a litre of normal saline daily for 4 to 10 days, according to the response, followed by (2) oral administration in 4-hourly doses of a daily total of 10 g. of sodium salicylate and 8 g. of sodium bicarbonate. Intravenous administration is not essential in all cases, but salicylates given intravenously are effective in controlling severe and refractory infections and may well be essential in such cases. The physiological and toxic effects of intensive salicylate therapy are described elsewhere by the same author (*J. Amer. med. Ass.*, 1946, **131**, 209). *G. F. Walker.*

Rheumatic Encephalopathy. LEYS, D. (1946). *Edinb. med. J.*, **53**, 444.

This paper is based on reports of 3 patients (2 aged 14, and 1 aged 21 years) who had acute rheumatism or chorea which set in at or shortly after puberty. The outstanding feature was, however, an unusual type of psychosis, definite enough for a psychiatrist to diagnose 2 of them as schizophrenic. Recovery in all the cases was sufficient for them to resume active life.

The author states that factors which give rheumatism a potential epidemic character are its geographical distribution, its association with poverty, its seasonal variation, and its annual variations in frequency. He says that in the Scottish Highlands the disease must be relatively rare, because in this region he has seen only 35 cases of acute rheumatism or chorea out of 8,430 of all sorts in six years. In the year before he saw the 3 cases of rheumatic encephalitis there was a high rheumatism rate, and he feels that the association of the schizophrenic symptoms with the acute rheumatism was not fortuitous. He says that the puberty of the three girls described coincided with a period not only of prevalence of rheumatism but also of prevalence or "enhancement" of pathogenic neurotropic virus.

R. Sands.

The Present-day Nosological Conception of Acute Rheumatism. (La conception nosologique actuelle de la maladie de Bouillaud.) BEZANÇON, F. (1946). *Ann. Méd.*, **47**, 7.

The author summarizes by saying that the most satisfying hypothesis is that we are dealing with an infection, or a series of sub-infections—with the portal of entry in the nasopharynx—responsible for an allergic (hyperergic) state. The question whether the allergen is a micro-organism or a toxin cannot yet be answered. Recent work shows that in these sensitized tissues the agent responsible for a relapse may not be a living micro-organism, but some foreign protein.

Aschoff nodes being found equally in synovial membrane and cardiac tissues, one must find a single pathogeny, and one cannot put forward an allergic hypothesis for the reactions in joints alone. But the profound clinical difference between the articular and cardiac manifestations seems inexplicable; one can only remark the greater abundance of Aschoff nodes in the cardiac tissues.

Kenneth Stone.

The Incidence of Rheumatic Fever; an Analysis of 225 Cases. (Om hyppidheden af febris rheumatica. En analyse af 225 tilfaelde.) HARVING, F. (1946). *Nord Med.*, **31**, 2,127.

Sudden Death in Rheumatic Fever. GRIFFITH G. C., and HUNTINGTON, R. W. (1946). *Ann. intern. Med.*, **25**, 283.

Still's Disease. (Enfermedad de Still.) DÍAZ NIELSEN, J. R. (1946). *Pediat. Amer.*, **4**, 415.

The Problem of Rheumatic Carditis. (El problema de la carditis reumática). SUAREZ, F. GONZALEZ (1946). *Gac. méd. esp.*, **20**, 483.

Rheumatic Heart Disease in Children. Recent Advances in Management. BAUMHAUER, J. A. (1946). *J. med. Ass.Ala.*, **16**, 135.

Rheumatic Heart Disease. (Maladie de coeur rhumatismale.) TETREAULT, A. (1946). *Un méd. Canad.*, **75**, 1,183.

Rheumatic Pneumonia. (Rheumatische pneumonie.) LINDEBOOM, G. A. (1946). *Ned. Tijdschrift. Geneesk.*, **90**, 1,568.

Mud-bath Cure for Children's Rheumatism at the Estuary Health Resort " Cold Ravine ". SKROTSKY, A. E., SOSNOVA, P. S., and CHERNYUK, V. P. (1946). *Pediat. Akush. Ginek.*, **4**, 3.

Acute Rheumatic Polyarthritis. (Zum Verlauf der akuten rheumatischen Polyarthritis.) LACHNIT, V. (1946). *Wein. med. Wschr.*, **96**, 456.

The Importance of Intensive Salicylic Acid Treatment in Developed Forms of Infantile Cardiac Rheumatism. (Formas evolutivas del reumatismo cardiaco infantil, importancia de la terapéutica salicilada intensiva.) BERTANI COSTA, G., and MINDLIN, S. (1946). *Pediat. Amér.*, **4**, 555.

Prevention and Treatment of Rheumatic Infection in Infancy. (Profilaxis y tratamiento de la infección reumática en la infancia.) BARRIOS, J. B. (1946). *Rev. esp. Pediat.*, **2**, 492.

Heart Diseases in Children in a Rural Iowa County—Particularly in Relation to Rheumatic Fever. JACKSON, R. L. (1946). *J. Pediat.*, **29**, 647.

Treatment of Malignant Forms of Acute Rheumatism. (Traitement des formes malignes de la maladie de Bouillaud.) LUTERMBACHER, R. (1946). *Rev. argent. Reum.*, **115**, 208.

A Case of Acute Rheumatic Arthritis and Chorea. (Sobre un caso de reumatismo poliarticular agudo y corea.) GRAPIOLO, C. ARTILIO, and MENSANI, G. ALFREDO (1946). *Rev. argent. Reum.*, **115**, 213.

Rheumatic Heart Disease. PROUT, B. EDGAR (1947). *Conn. med. J.*, **2**, 98.

Rheumatism in Children in the Americas. (La enfermedad reumatica del niño en America.) ESCARDÓ Y ANAYA, V. (1946). *Rev. argent. Reum.*, **11**, 143.

Rheumatic Fever with Chorea Minor (in English). JACOBSSON, E. (1946). *Acta paediatr., Stockh.*, **33**, Suppl. 7, p. 1.

Articular Rheumatism (Arthritis)

Critical Evaluation of some Factors in Progressive Chronic Rheumatism. (Fattori sopravalutati e fattori scarsamente considerati nella etiopatogenesi del rheumatismo cronico evolutivo.) PANSINI, GIROLAMO (1946). *Rif. med.*, **60**, 385.

This is a highly speculative paper on the aetiological factors in chronic rheumatism. The type of case discussed is one in which the origin and evolution of the disease are slow, with occasional acute phases accompanied by pain and a little fever, and with symmetrical distribution of joint lesions, particularly in the fingers. Stiffness and deformity of the joints involved follows, and the final phase is one of arrest of the process.

In the aetiology, infection, endocrine factors, and neurogenic factors are considered. The influence of the infective focus would seem to have been over-estimated. Infective foci are many, and cases of chronic rheumatism are few, while removal of the focus seldom influences the disease. On the subject of allergy to an infective factor the author remains neutral. The relation to ovarian endocrine activity is stressed, emphasis being laid on the high incidence in women and the occurrence at the menopause or in association with ovarian hypofunction. The peripheral vascular phenomena found sometimes as concomitants of the disease are also considered to be of endocrine origin. The essential symmetry of the lesions is emphasized, and this is considered to be related to a neurogenic factor in their origin. The lesions are considered to be the result of an interplay of all three factors, and a minor role is allotted to injection.

[The author's speculations are not supported by clinical or experimental evidence, and his references are chiefly to old and obsolete work.]

E. Rosenthal.

The Treatment of Tuberculous Arthritis. KISCH, E. (1946). *Amer. Rev. Tuberc.*, **53**, 533.

The treatment of tuberculous arthritis has undergone many changes. When joint tuberculosis was held to be a primary infection, joint resections were popular. Immobilization in the traditional plaster cast came next, possibly associated with heliotherapy in high mountains and open air. The author of this paper discusses tuberculosis of the knee-joint in 253 cases seen in Germany between 1920 and 1929. He holds that the joint need not be immobilized, but only relieved of its weight-supporting functions. Traction prevents muscular cramps and deformities of the joint. After pain and muscular spasm has disappeared, passive motion exercises are introduced, carefully

avoiding pain. These not only maintain existing mobility, but restore lost mobility in many cases. Corrective operations may be performed after the joint is healed. The tendency to heal is as great among adults as among young people. The hyperaemic effect produced by sunshine, associated with passive congestion, obtained by Bier's method with rubber bandage, causes granulation tissue to develop, which attacks and disintegrates any sequestrae; thereafter the cavities fill with new normal bone tissue.

A special technique is described for puncture of tuberculous abscesses, which prevents the formation of sinuses; it has been used over 90 times on the same abscess without a sinus forming. The value of solar radiation is stressed, whether administered in high mountains or flat lands; it sets up hyperaemia which penetrates such deep tissues as muscles and bones; it should be combined with open-air treatment which has the same stimulating effect, and should be given night and day. *X* rays in small dosages are also of value. Detailed statistics upon which these conclusions are based have been published elsewhere. They are held to establish that functionally adequate mobility was attained in all of 11 hydrops cases, in 60% of 79 fungous cases, and in 28·4% of 163 osseous cases. A joint healed with mobility does not fatigue more easily than an ankylosed joint, and does not become painful on use. Bone and joint tuberculosis should be treated in the same climate in which the disease was contracted. No " matter of principle " treatment should ever be adopted, whether conservative or surgical. *E. L. Collis.*

Twelve Years' Experience in Roentgenotherapy for Chronic Arthritis. KUHNS, J. G., and MORRISON, S. L. (1946). *New Engl. J. Med.*, **235**, 399.

Of 370 selected patients suffering from chronic arthritis, the improvement that occurred after roentgenotherapy in 78·4% was mild in 24·1, moderate in 37·2 and marked in 17·1%. The greatest improvement (84·6%) was seen in rheumatoid arthritis of the spine. In rheumatoid arthritis without spondylitis 79·2% of patients improved. In osteoarthritis the least improvement occurred—72%. The decrease in subjective symptoms almost paralleled the objective changes. Duration of symptoms had little effect on end-results. The condition of the joint was the most important factor. Repeated courses of *x*-ray treatment did not ensure the permanence of the improvement.

Roentgenotherapy is useful in selected cases, and its chief indications are chronic inflammation in a joint that has not responded to rest and physiotherapy, pain and stiffness in osteoarthritis, and muscular spasm and spinal limitation of motion and pain in rheumatoid arthritis of the spine.

In the 80 patients who showed no response to roentgenotherapy the principal reasons for failure were severe deformity or mechanical derangement of the joint, cancer not found in the first *x*-ray examination, and serious systemic disease. [*From the authors' summary.*]

The Presence of Megaloblasts in the Bone Marrow in Cases of Chronic Primary Polyarthritis. (Sulla presenza di megaloblasti nel midollo osseo di alcuni casi di poliartrite cronica primaria.) MARMONT, A. (1946). *Boll. Soc. ital. Biol. sper.*, **22**, 156.

During investigation of 20 cases of " chronic primary polyarthritis ", the author observed, in some at least, a peculiar type of cell in the bone marrow, which seemed to be intermediate between a primitive reticular cell and a basophil erythroblast (histioid cell), while the ordinary haemocytoblast was almost completely lacking. It is a voluminous cell, with abundant nongranular basophilic cytoplasm and a dark reddish-violet nuclear protoplasm and extremely delicate nuclear network. May-Grünwald-Giemsa staining was used. The cell is intermediate between the normoblast and the megaloblast, with dark-violet mitotic figures of the chromatic loops among the still basophilic elements. It is to be classed among the megaloblasts, but is distinct from the normal megaloblast; it is observed in certain anaemias—primary hypochromic and post-haemorrhagic anaemias, and in those associated with pregnancy, sprue, septicaemia, coeliac disease, and pulmonary tuberculosis. The author regards the cell as a by-product or " displacement " in the course of red-cell formation, with a skipping of the normal haemocytoblast stage; and in chronic primary polyarthritis, as in pernicious forms of anaemia in general, the actual cause is " stimulation and irritation of bone marrow, functionally disturbed ". *H. Harold Scott.*

Still's Disease (Atrophic Arthritis, Atrophic Rheumatoid Arthritis or Infectious Rheumatoid Arthritis). BURDICK, W. F. (1946). *Sth. med. J.*, **39**, 626.

The author recalls Still's original description (*Med.-chir. Trans.*, 1897, **80**, 47) of the syndrome of arthritis, splenomegaly, adenopathy, and leucocytosis in children, and states that this condition is now recognized as " a modification of atrophic arthritis ". Continuing to refer to " Still's disease " throughout his paper, he describes the syndrome of rheumatoid or atrophic arthritis. He finds that it is frequently associated with a strong family history of rheumatic disease ; women are more commonly affected than men, and persons exposed

to infection, fatigue, and emotional strain are more liable to it than others. It is probably infectious in origin. Attempts have been made directly to incriminate foci of infection, the streptococcus, allergy, and vitamin B. The disease is temporarily improved by jaundice, pregnancy, and by surgical operations under general anaesthesia.

A description is given of the clinical findings in rheumatoid arthritis. Fever is usual, and nodules may be found in some 20% of sufferers. Local signs are symmetrical polyarthritis and muscle atrophy. Remissions or spontaneous recovery may occur, but in uncontrolled cases the disease may proceed to crippling and possibly bony ankylosis of the affected joints. Some aspects of the pathology and radiological appearances are described. Treatment consists in general care and orthopaedic measures to prevent crippling; alleviation rather than " cure " is all that can generally be expected. Vitamins, vaccines, and protein shock are sometimes used, but are not specific. The author mentions the use of gold salts, but considers their administration to be " not without danger ". Two case histories are given.

W. Tegner.

Aetiopathogenesis of Cardioarticular Rheumatism. (Etiopatogenia del reumatismo cardioticular.) MIGUEL, S. (1946). *Rev. esp. Pediat.*, **2**, 485.

Office Management of Chronic Arthritis. SHERWOOD, K. K., and ZIMMERMAN, B. (1947). *Northw. Med., Seattle*, **46**, 30.

Pyogenic Osteomyelitis of the Spine. MARTIN, P. (1946). *Brit. med. J.*, **2**, 688.

(Spondylitis)

Infective Spondylitis. (Quelques cas de spondylite infectieuse). PERRIER, H. (1946). *Radiol. clin., Basel*, **15**, 259.

Apart from a tuberculosis origin, a more or less circumscribed pain in a vertebra or along the spine is generally due to some other infection. Sometimes the symptoms develop after an illness, such as pneumonia, typhoid fever, or brucellosis. Micro-organisms in the bone marrow or vertebrae may cause two different clinical pictures. In the first, acute vertebral osteomyelitis may develop rapidly; and in the second there may be a more protracted, subacute illness, which about 40 years ago was named by Fraenkel infective spondylitis (*Mitt. Grenzgeb, Med. Chir.*, **12**, 419). Vertebral osteomyelitis, being an acute inflammation, appears generally with intense pain and fever, and is a serious and sometimes fatal disease which progresses rapidly and may lead to spinal meningitis. Infective spondylitis is, in contrast, a chronic infection with two outstanding symptoms—obstinate dorsal pain, and mild pyrexia. The prognosis is fairly good. Generally no extensive vertebral changes are observed. Thus, infective spondylitis may be regarded as a chronic osteomyelitis. The disease may result sometimes from acute osteomyelitis, while in other cases it evolves slowly. It usually lasts for some months. Radiographs show changes in or near the intervertebral disc; the infective process in the vertebra is as a rule very near to the disc. The first radiographic sign is a diminution in height of the disc, and it is thought that herniation of the nucleus pulposus occurs in the body of the adjacent vertebra in the zone destroyed by the process of chronic inflammation. After about ten weeks extensive osteophytic reaction appears.

The case records vary. In 2 there was a general infection accompanied by bacteriaemia causing vertebral metastases. In 2 others the disease took a slow course, secondary respectively to oral and tonsillar infection: elimination of foci produced benefit. Four cases had a more isolated form of the disease, with no infective focus. Osteophytic lipping of the vertebral bodies is met with more frequently than subjective complaints.

Eugene Rosenthal.

(Miscellaneous)

Painless Treatment of Ankylosed Joints. ECHTMAN, J. (1946). *Med. Rec., N.Y.*, **159**, 477.

The author claims that a method of treatment of fibrous ankylosis by combined ionization and the interrupted sinusoidal current has in his hands, over a period of 19 years at the Mount Sinai and other hospitals, given results superior to those of the dangerous *brisement forcé* and the much slower, and in severe cases useless, methods of occupational therapy. The treatment is painless. The author believes that the " desired results " can be obtained in at least 95% of cases. The joint is ionized with drugs selected for their lytic and softening effect on fibrous tissue, after which the action of the interrupted sinusoidal current breaks down the softened adhesions. Three drugs used are: sodium chloride (1%) best for post-traumatic ankylosis; sodium salicylate (1%), best in rheumatoid ankylosis; and iodine

5 minims of the 7% tincture to 1 oz. of water, best where ankylosis follows sepsis. The drugs are used in watery solution. The active electrodes are laid on the outer aspect of a towel folded eight layers thick and soaked in the hot solution and wrapped round the joint. The larger inactive electrode is placed on a similar towel which is soaked in plain warm water and laid on the back of the same side as the limb being treated. The current is raised gradually to the patient's tolerance or to 1–2 mA per square inch of area of metal of the active electrode. Initially, treatments last for 20 minutes; they work up to 1 hour and are continued at this level. As soon as the ionization is completed the interrupted sinusoidal current is applied through the same electrodes as 20–22 interruptions per minute, starting with a mild current and increasing to just below the patient's tolerance (for half a minute initially, rising to 10 minutes), at which level it is applied for as many days as necessary.

Difficulty in ionizing the deep-lying hip-joint is admitted. " Frozen shoulder " is considered in some detail, and the two types, with and without calcified deposits, are distinguished, the former unexpectedly carrying the better prognosis. The author attributes pain, when present, to an active chronic inflammatory process, and recommends treatment by magnesium-ion transfer until pain has disappeared. After this, treatment of the adhesions by the combined method is begun. Short- and long-wave diathermy are considered as auxiliary or alternative methods, the author reporting that the shorter the wavelength the less useful is diathermy in ankylosis.

O. J. Vaughan Jackson.

Knee Fusion by the Use of a Three-Flanged Nail. BOSWORTH, D. M. (1946). *J. Bone Jt. Surg.*, **28**, 550.

Bosworth advocates using a 3-flanged nail 4 in. long, of the Smith-Petersen type, to secure immediate stability after a knee fusion operation. He has obtained a sound ankylosis in 14 knees with this method. Two were cases of Charcot's disease. The nail is introduced medially above the femoral condyle and driven obliquely through the femur into the tibia. The method has not been used in cases of tuberculosis, osteomyelitis, or suppurative arthritis or in cases in which an epiphyseal line still existed.

George Perkins.

Gonorrhoeal Arthritis in the Newborn. (Arthritis gonorrhoica hos nyfödda.) FORSSELL, P. (1946). *Nord. Med.*, **31**, 1,953.

Non-Articular Rheumatism

Lesions of the Musculo-tendinous Cuff of the Shoulder. GUNNING, N. S. (1946). *Med. J. Austral.*, **2**, 593.

Four lesions in the region of the shoulder are described—bursitis, strain of the normal musculo-tendinous cuff, tendinitis, and complete rupture of the cuff.

Bursitis is said to be usually a secondary condition. When primary, it follows excessive unaccustomed use of the joint, resulting in complete limitation of all movements at the shoulder joint and severe pain. Prolonged physiotherapy is usually necessary before relief is obtained.

Strain of the normal cuff follows an injury to previously normal shoulders in young adults. The pathology is said to be similar to that of a strain in any other ligamentous or tendinous tissue. A few fibres are torn off the insertion of the tendon, and this is followed by the usual reaction—haemorrhage and swelling. The symptoms are: (1) pain referred to the deltoid insertion, to the supraspinatus, or to the side of the neck, and especially occurring at night; (2) a tender spot at the point of the shoulder; (3) faulty scapulo-humeral rhythm. Early cases are treated by rest on abduction splints for three weeks. Late cases receive procaine injections.

Tendinitis causes intermittent aching for months. The patients are usually older and have seldom suffered injury. Degenerative changes occur in the tendon of the supraspinatus and in the cuff as the result of repeated minor traumata by the sharp outer edge of the acromion. Tears or calcification may follow. Physiotherapy usually cures.

The clinical picture of complete rupture of the cuff has been described by Codman as follows. The patient, usually a manual labourer over 40, complains of pain immediately after injury. He is found to have difficulty in elevating his arm, unless he is stooping. There is faulty scapulo-humeral rhythm, a tender spot over the site of injury, and a sulcus and eminence, which disappear under the acromion when the arm is raised. There is soft crepitus at the tuberosity. The *x*-ray findings are negative. The lesion may occur without any history of injury; surgical repair is recommended. An arthrodesis may be necessary.

Partial rupture of the cuff may not be associated with a history of injury. The importance of scapulo-humeral rhythm is emphasized. It is reversed in these cases, but becomes normal in the stooping position. Physiotherapy and exercises in the stooping position should be given a long trial. If they fail, operative repair should be undertaken, with removal of a part of the acromion if necessary. After operation the limb is splinted in abduction.

F. P. Fitzgerald.

Prognosis in So-Called Sciatic Neuritis. DUNNING, H. S. (1946). *Arch. Neurol. Psychiat., Chicago.*, **55**, 573.

The author considers that " the symptoms and signs of herniation of the nucleus pulposus in the fourth or fifth lumbar intervertebral disc are indistinguishable from the well-defined syndrome that was formerly called sciatic neuritis ". He reports a follow up of from 15 months to 23 years (average 5 years 1 month) of 55 patients of the New York Hospital who were " reliably diagnosed " as cases of sciatic neuritis. Group 1 (36%) had been continuously free from pain since subsidence of the first attack, which had lasted for periods of from 11 days to 3 years (average 7 months); the period since recovery had been from 1 year to 7 years 8 months (average 3 years 5 months). Group 2 (8%) had persistence, recurrence, or development of pain in the lower part of the back since subsidence of pain in the leg, none of the patients being disabled. Group 3 had recurrence of pain in the leg with or without pain in the lower part of the back: in 14% this was of little importance and did not interfere with former activity; in 29% it was considerable, but allowed light work; and in 13% it was disabling. The last group included 5 patients on whom successful operations were performed. No conclusions as to prognosis could be drawn from the protein content of the cerebrospinal fluid. Decreased sensation and weakness were more frequent in the " satisfactory " than in the " unsatisfactory " group. Twice as many men as women were involved. A difference in age distribution suggested a better prognosis in the older age-period. The author concludes that removal of the herniated nucleus promptly relieves pain and improves the prognosis, but the defect may be repaired by " natural processes ", and these should be given an opportunity before operation is urged.

F. S. Jocelyn.

Protruded Cervical Intervertebral Discs—A Cause of Brachial Neuritis. JAMES, E. S. (1946). *Canad. med. Ass. J.*, **55**, 139.

The author describes the presenting symptom of protruded cervical discs as pain in the neck or shoulder, radiating down the arm, particularly at night; it is increased by movement, coughing, and sneezing. The discs between C5 and 6 and between C6 and 7 are the commonest to be involved. The author thinks the condition can be " readily diagnosed " by clinical examination, but he appears to rely a good deal on the narrowing of the disc seen in a lateral radiograph with or without the help of lipiodol. All cases of so-called scalenus anticus syndrome are attributed to this cause, and so are many of alleged cervical rib and subacromial bursa; it is not believed that cervical osteo-arthritis is a frequent cause of pain. Conservative treatment is favoured, largely owing to the anatomical difficulties of operating, and the article mentions 38 cases in the last year with operation upon only 4 of them. Treatment includes rest, sedatives, extra pillows to flex the neck, a collar, and large doses of vitamin B (amount not stated). Continuous skull traction with a halter often gives temporary or permanent relief in a few days. [This paper is largely an expression of opinion, and the 38 patients are not described in detail. The reader is left with the impression that other causes might have produced the same symptoms and that different treatment might equally well have relieved them.]

Eric I. Lloyd.

Backache in Soldiers. STUCKEY, D. (1946). *Med. J. Austral.*, **1**, 838.

The author discusses an unselected series of 40 cases of backache occurring over a period of three months in a unit of 700 men, all of whom had served for two years or more. The technique of physical examination is described. Ranges of movement of the spine, sacro-iliac, and hip-joints are estimated. The usual method of measuring the leg from the anterior superior spine to the internal malleolus is condemned in favour of the following. The patient lies supine; the anterior superior iliac spines are palpated, and the pelvis set exactly square by comparison with a piece of string held across the table at right angles. The legs are then laid parallel to the sides of the couch, the heels being together and the booted feet steadied at right angles to the legs. Differences in length can be measured accurately with a ruler from the level of the heel of one boot to the other. Of the 40 cases, 35% were found to be due to postural syndrome and 57·5% to fibrositis. The typical history of postural syndrome was of poorly localized, dull, aching pain, relieved by rest, and occurring in those of poor physical and psychological make-up. Many had legs of unequal length and were relieved when the boot heel on the shorter leg was raised.

The aetiology of fibrositis is considered under the following headings: (1) trauma, (2) infection, (3) posture (14 out of 24 patients suffering from fibrositis had legs of unequal length), (4) cold, dampness, and chill, (5) unclassified. Heat, rest, and salicylates are recommended in the acute stage; heat, followed by massage and exercise, together with raising the heel of a short leg, and local infiltration with procaine or proctocaine are recommended in the subacute and chronic stage.

Bone and joint lesions as causes of backache

are mentioned, and it is stressed that spondylolisthesis, with its clinical picture of pronounced lumbar lordosis, prominent abdomen, and loss of the normal interval between the lower ribs and iliac crests on both sides, may be present for the first time in adult life. Cases of nerve-pressure syndrome and referred pain from visceral disease usually present physical signs which should direct investigation along the right lines. *Geoffrey McComas.*

Therapy of Low Back Pain by Manipulation and of Referred Pain in the Lower Extremity by Procaine Infiltration. TRAVELL, J., and TRAVELL, W. (1946). *Arch. phys. Med.*, **27**, 537–547.

This article describes a " corkscrew " manipulation slightly different from that already employed by manipulative surgeons for many years, for reducing displacement at the sacro-iliac joint. The operator's hand lies on the ischial tuberosity rather than on the greater trochanter, so as to ensure rotation and lumbar extension when the pelvis is twisted. The authors believe that otherwise the manipulation may painfully subluxate the sacro-iliac joint. No ill effects were observed when 400 patients with low backache were manipulated without anaesthesia, and dramatic relief was " sometimes " secured (no figures given).

Infiltration of spastic muscles with 0·5% solution of procaine or with normal saline is next advised, since the muscles are thought to contain painful trigger areas. Pain referred to the lower limb—that is, sciatica—occurred in 44% of their cases diagnosed as sacro-iliac displacement, and arose from trigger-points in the gluteus medius, gluteus maximus, pyriformis, and thigh adductor muscles, in descending order of frequency. The authors point out that artificially induced pain referred from the anterior fibres of the gluteus minimus occupies the fourth and fifth lumbar dermatomes, whereas that from the posterior fibres occupies the first sacral dermatome, thus confirming part of Kellgren's work. They consider that, when spasm involves only part of a muscle, stretching the muscle is painful and active contraction appears weak. The theory is advanced that spasm of the pyriformis muscle, complicating sacro-iliac strain, may compress the sciatic nerve trunk in those cases (8%) in which the nerve passes through the substance of the muscle, thereby setting up signs of lack of conduction along the nerve.

[This paper is a retrograde step dating back to the days following Lewis's discovery in 1936 of reference of pain from somatic structures. For several years these findings were applied in error to symptoms felt in the buttock and thigh; they were abandoned when it was realized that internal derangement of a low lumbar intervertebral joint is the common cause of such pains, and that reduction of these displacements is the usual manner of obtaining manipulative cures. It is to be regretted that the concept of gluteal muscle syndromes is revived and that forced rotation of the pelvis on the thorax (and thus of the spinal joints) is once more put forward as a means of reducing sacro-iliac subluxations. The criteria given in the article for diagnosis of the gluteal syndrome are inadequate.] *J. H. Cyriax.*

Sciatica caused by Separation of the Posterior Border of a Vertebral Body. (Über "Abtrennung" der hinteren Wurbelkörperkante als Ursache von Ischias.) MEYENBURG, H. v. (1946). *Radiol. clin., Basel*, **15**, 215.

The author reports and discusses at great length a case of separation of the posterior lower border of the fourth lumbar vertebra which gave rise to sciatica. Radiographically there was destruction of the postero-inferior border of L4 with formation of osteophytes causing a narrowing of the intervertebral foramen between L4 and L5. The disc between L4 and L5 was slightly narrowed. The patient died from intercurrent disease, and the necropsy revealed the absence of infective changes in the involved region. There was no history of trauma to explain the separation, and the author assumes that it was caused by occupational stresses on the spine.

A. Orley.

The Exposure of High Lesions of the Sciatic Nerve. AIRD, I. (1946). *Surg. Gynec. Obstet.*, **83**, 369.

The author describes the incision for exposure of high lesions of the sciatic nerve. The approach is that of Fiolle and Delmas (*Surgical Exposure of the Deep-seated Blood Vessels*, translated by C. G. Cumston, London, 1921). The main difficulties encountered in the repair of a high lesion of the sciatic nerve are: (1) haemorrhage from the trunk or branches of the inferior gluteal vein; (2) retraction of the neuroma into the pelvis; (3) inability to rotate the nerve for insertion of the anterior sutures; and (4) the liability of damage to the posterior cutaneous nerve of the thigh, particularly when the incision is closed.

The Value of Physical Agents in the Treatment of Chronic Rheumatism. (Que valent les agents physiques dans le traitement du rhumatisme chronique.) DUFRESNE, O. (1946). *Un. méd. Canad.*, **75**, 1,060.

OBITUARY

We regret to record that Dr. A. R. Neligan died, after two days' illness, on December 8, 1946, at the age of sixty-eight.

Born in Tralee, County Kerry, Anthony Richard Neligan was the son of Dr. J. W. Neligan, who was in practice in Tralee. He received his medical education at St. Bartholomew's Hospital, to which he remained all his life very loyal, and where he had a first-class record as an undergraduate, securing, among many other prizes, the Brackenbury Scholarship and the Matthews Duncan Gold Medal. He qualified M.B. in 1903, taking his M.D. in 1905. Between 1903 and 1906 he held several House appointments at Bart's.

After 1906 his professional work was divided into two distinct parts. The first period was administrative, and began with his appointment in 1906 as physician to the British Legation in Teheran; during the twenty years of his tenure he was one of the British representatives on the Persian Sanitary Council, for which body he did much valuable work. In 1926 he published a review of the work of the Persian health services, in which he drew attention to the establishment of a Pasteur Institute and a Public Vaccination Service, and to the great progress being made in sanitation.

On retiring from his appointment in Teheran, he concentrated on rheumatic diseases. He spent eighteen months in visiting spas, rheumatic clinics, and hospitals in America and Europe, and was then appointed Superintendent of the Red Cross Clinic for Rheumatism in London. In 1931 he settled in Droitwich Spa as a consultant in rheumatic conditions, a branch of the profession for which his special training, and his experience while in charge of the Red Cross Clinic at Peto Place, had so well qualified him.

Dr. Neligan belonged to many societies devoted to the study of the causes and treatment of rheumatism. He always made an effort to attend rheumatism conferences at home or abroad, and he made many contributions to the discussions at such meetings. For example, he contributed an interesting paper on sulphur metabolism in rheumatoid arthritis to the International Conference on Rheumatoid Arthritis held in Aix-les-Bains in 1934. An article on diagnosis and treatment of fibrositis and neuritis appeared in the *Practitioner* in 1939; and in 1945 he contributed to the *Proceedings of the Royal Society of Medicine* a paper on osteo-arthritis.

During his whole life Dr. Neligan remained a student. He read widely, not only in his own department but also generally, thus keeping himself abreast of recent developments. As a speaker he was deliberate, but always made his points effectively. As a chairman or secretary he was accurate, at times almost fastidiously so. In his view no detail was too unimportant to be carefully considered, this habit probably being the result of his twenty years' administrative work in Persia. He was a "good mixer", and at the many congresses and conferences he attended he made numerous contacts with his professional colleagues of all nationalities.

Dr. Neligan's chief recreation was fishing, but he was also a great walker and lover of nature, and a keen gardener. He took an interest in architecture, chiefly ecclesiastical. After settling in Droitwich he called on every Bart's man resident in Worcestershire, and on several occasions brought them together socially. He will be missed by many friends and colleagues.